PERFORMANCE-FUNDING INDICATORS AT TWO-YEAR POSTSECONDARY INSTITUTIONS:
DEVELOPING A VALUE-ADDED MODEL FOR EQUITABLE FUNDING

By

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This work is dedicated to my late father, Roger E. Whigham.

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Abstract of Dissertation Presented to the Graduate School
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Higher education's increased use of performance-based funding (PBF) and performance-based budgeting (PBB)—linking funds to institutional performance on quantitative or qualitative criteria—created debate in two areas: the selection of valid performance indicators (PIs) and the use of those indicators for institutional comparisons and funding. Institutional performance, as most often defined in the performance-funding arena, relied on easily measured institutional graduation rates and transfer rates. The problem with most systems of performance-based funding, which relied on these absolute performance indicators, was that they failed to capture the large diversity of community college student intents, abilities, goals, and outside responsibilities.

This dissertation worked toward a value-added model which could provide a cost-effective way to accommodate and reward a substantially expanded range of learners and student goals while still making funding dependent on demonstrated outcomes. Instead of reliance on absolute indicators of institutional performance, such as graduation or transfer rates, the value-added approach established an appropriate reference norm by accounting for the diverse backgrounds and intents of first-time college freshmen at community colleges.

The logistic regression analysis utilized in this study resulted in a model that included two independent predictor variables for the outcome variable: graduation or transfer. The model predicted the graduation or transfer rates of the group sampled with approximately 62 percent accuracy. A more precise model should be developed before it is used for performance based funding or performance based budgeting purposes.

CHAPTER 1
INTRODUCTION

In response to state policymakers' interest in the accountability and performance of higher education institutions, many community colleges found that performance assessment policies of the mid-1990s inadequately rewarded this segment's contribution to postsecondary education. Performance-based funding (PBF) and performance-based budgeting (PBB)—linking funds to institutional performance on quantitative or qualitative criteria—created debate in two areas: the selection of valid and reliable performance indicators (PIs), and the interpretation and comparison of such measures of success across institutions and systems.

Using absolute performance indicators for the assessment of postsecondary institutions presented difficulty because PIs could not be accurately interpreted without knowledge about the type of students admitted by individual institutions. As Astin wrote, "Such quality judgments [were] meaningless without 'input' data on the students when they first enroll[ed]."[1] He argued that "'outcome' scores [such as graduation and transfer rates] [were] probably telling us much more about the population recruited by the school than they [were] about the effectiveness of the school's academic program."[2]

Purpose

The purpose of this study was to examine the use of performance assessment and performance-based funding and budgeting (PBF&B) in United States community colleges. This study was designed to (1) determine whether current models and PIs used for PBF&B were appropriate for use in two-year postsecondary institutions and, if not, to (2) develop a predictive model of community college student performance which could be used as PIs for the assessment of community colleges. This analysis used a database containing longitudinal data collected from a nationally representative sample of community college students. The method used to address this question was first, to determine the PIs most commonly used for the assessment of four-year postsecondary institutions, and then, to develop a model for adapting those indicators to the two-year postsecondary sector. Did the most commonly utilized PIs accurately assess the performance of two-year postsecondary institutions?

Research Question One

Performance Assessment and Performance Measures for the Allocation of Funds

The first research question addressed by this study pertained to the use of performance assessment and performance measures in the allocation of state funds to postsecondary education institutions. Was performance assessment for funding allocations utilized for both two-year and four-year colleges and universities? What portions of their individual budgets did the states allocate in this manner? Which states had used, were using, and planned to use this type of funding allocation? Did states use multiple measures of institutional performance to allocate funds? How many institutional performance measures did states utilize? Were institutional performance measures the same for all postsecondary institutions? Specifically, were there different measures of performance for four-year and two-year colleges and universities? What were the measures of postsecondary institutional performance most frequently used for the allocation of funds? This research question was answered through a review of the literature and was addressed in chapter two.

Research Question Two

Accuracy and Flexibility of Performance Measures

The second research question addressed by this study focused on the degree to which the institutional performance measures utilized by states and institutions accurately measured the performance of community and two-year colleges. Could the outcome measures commonly used by states and institutions accurately depict community and two-year college performance? How feasible was the development of performance measures to account for differences in levels and types of institutions? Specifically, was there a model that could be used as an accurate performance indicator for both two-year and four-year postsecondary institutions?

This research question was answered through a review of the literature and through the use of logistic regression analyses to develop a model of community college performance. This research question is addressed in chapters two and three, respectively.

Evolution and Uses for Student and Institutional Performance Measures

Virtually all the literature concerning student and institutional performance assessment confined its scope to four-year residential institutions—"It ignore[d] the large and growing population of students who beg[an] their careers in postsecondary education in two-year or community colleges."[3] This large body of research originally focused on the affects of postsecondary education on students' lives.[4] During the decade of the

1980s, however, performance data became a means of evaluating and motivating efforts to improve undergraduate education.[5] More recently, student and institutional outcome data were used to evaluate the productivity and performance of postsecondary institutions and systems.[6] As states increasingly used institutional performance indicators to allocate funds to postsecondary education institutions—as with PBF&B—this research found yet another function.[7]

This study focused specifically on the community college system for four distinct reasons, which follow.

Community College Enrollment Size

The first reason for focusing on the community college sector was the significant (and often overlooked) role of these institutions in the nation's postsecondary education system.[8] Despite the fact that almost half of the beginning postsecondary education students began at community and two-year institutions, the majority of research on college student success and institutional performance was focused on the traditional four-year college sector.[9] For this reason, less was known about community and two-year colleges and the students who attended these institutions than was known about the four-year college sector.[10]

Traditional Assumptions about College Students

A second reason this study focused on community colleges was because most of the institutional performance measures being used for state funding allocations were based on outdated assumptions about postsecondary student populations.[11] For example, allocations based on the percentage of students graduating within six years assumed that all students attended college on more than a part-time basis, that they all intended to obtain a degree, and that all entering students engaged in college-level course work during the first term of college.[12]

Similarly, funding based on transfer rates to four-year colleges assumed that all students who attended community colleges intended to later transfer to four-year colleges.[13] In addition, because community colleges were attended by a larger proportion of part-time students than were traditional four-year colleges and universities,[14] commonly used PIs (such as time-to-degree) did not adequately capture this sector's contribution to higher education.[15]

The "At-Risk" Population

The third reason for focusing on community colleges was that these institutions had the largest percentages of "at-risk" students. For example, according to the National Center for Education Statistics (NCES), freshmen in public two-year colleges in 1995 were far more likely to enroll in remedial courses than were freshmen in public four-year institutions (41 versus 22 percent).[16] In general, the "open-door" admissions policies at community colleges meant that these students were in greater need of academic counseling, remedial or developmental courses, and other student services than were students attending more selective four-year colleges.[17]

Further, although the "college access gap" between whites and blacks and whites and Latinos had closed from the 11-15 percent range to 5 percent over the past two decades, research showed that the degree completion gap remained at approximately 20 percent over the past two decades.[18] Since two-year colleges were more likely to have larger percentages of minority students than were their four-year college counterparts, it followed that these institutions were also more likely to experience lower graduation rates.[19]

Need for Different Predictors of Success

The fourth reason for focusing on community colleges was because past studies on student predictors of success had dealt primarily with traditional-age, full-time college freshmen at four-year colleges and universities.[20] Since many of these variables were not part of two-year college life, some of the predictors of success for four-year college students were inapplicable predictors of success for community college students.[21]

For decades, Alexander Astin and Vincent Tinto studied the student characteristics most predictive of college persistence and success in the four-year college sector.[22] Their work supported the theory that pre-college student characteristics were highly predictive of student success in college.

More recent research used predictive models of student persistence and graduation as a means of assessing the performance of four-year colleges.[23] Mortenson,[24] along with Johnes and Taylor,[25] used the findings of Astin and Tinto to develop a means of institutional comparison by creating models that took into account those variables largely out of individual institutional control.[26] These researchers found that a more accurate assessment and comparison of four-year institutional performance could be obtained by accounting for various student characteristics that most strongly predicted persistence and graduation rates at four-year colleges. This method could also be applied to the two-year college sector, assuming the longitudinal data was available for students at this institutional level.

There were several reasons why there was little known about the factors that influenced community college student persistence and withdrawal behavior.[27] One explanation for the relative lack of information about community college students and institutions was the difficulty of conducting longitudinal research on such a transient cohort.[28] Adelman found that "[t]he increasing complexity of [postsecondary students'] attendance patterns [was] one of the most significant developments in higher education of our time, one that pose[ed] grave challenges to system-wide planning [and] quality assurance."[29] The tracking of community college students tended to be more difficult than tracking traditional-age, four-year college students, since community college students were more likely to transfer many times before completing a degree or certificate program.[30]

Data Utilized

By utilizing newly available data about community college students—the Beginning Postsecondary Students Longitudinal Study (BPS:90/94) conducted by the National Center for Education Statistics (NCES)[31]—this study was able to extend the work of Astin and Tinto, who examined four-year college student predictors of academic achievement.[32]

The BPS:90/94 restricted-use data set used in this study was the first national longitudinal study to include a large and comprehensive number of variables for a nationally representative sample of community college students.[33] Because the BPS:90/94 included both traditional- and nontraditional-age students, this sample was representative of all beginning students in postsecondary education.[34] BPS:90/94 provided information on persistence, progress, and attainment of students from their initial time of entry into postsecondary education through their leaving school and entering the work force.[35]

BPS:90/94 followed first-time, beginning students for five years (through the spring of 1994), and collected student data and financial aid reports. By starting with a cohort that had already entered postsecondary education (from the NPSAS:90),[36] and following it for five years (with first and second follow-ups in spring of 1992 and spring of 1994, respectively), BPS:90/94 determined the extent, if any, to which students who started postsecondary education at various times after high school differed in their progress, persistence, and attainment.[37] (Incidentally, a new cohort of beginning postsecondary students from 1995-96 was followed beginning in 1998, which may provide a means for repeating this study for future generations of community college students.)

This rich data source from NCES allowed for the development of a predictive model of community college students' graduation and transfer behavior, a model which could later be applied to individual institutional data, compared to actual institutional graduation and transfer behavior, and used for the assessment of community colleges. Because the BPS:90/94 restricted-use data set allowed this researcher access to individual student data, the unit of analysis was the student.[38]

Predictors of College Student Success

Although most of the literature on institutional assessment focused on the four-year college sector, the methodology[39] and variables used for this sector offered a logical starting point for research on two-year colleges and students. Based on prior research concerning the four-year college sector and its students,[40] student-related variables were selected for inclusion in a multiple logistic regression analysis. The variables discussed below were analyzed for possible use in the regression analysis.

According to the research of Jill Johnes and Jim Taylor[41], entry qualifications—entrance exam scores, academic ability, and type of high school attended—were three of the strongest student-related, pre-college variables affecting student success at four-year colleges.[42] According to these researchers, other strong predictors of academic success included student gender, subject mix (specifically, business, social science or language programs), on-campus residency, and starting age at first postsecondary institution (i.e., delayed enrollment).[43]

Astin's research supported the theory that student characteristics prior to entering postsecondary education were the most important predictors of college success.[44] Specifically, Astin found that high school grades, SAT scores, race, and sex were the strongest predictors of college student persistence.[45] Other important student background characteristics included the type of high school attended, religion, educational level of father and mother, birth order, number of siblings, family income, age, high school achievements, average grade in high school, and the achievement of twelve specific honors in high school.[46]

Astin's research also indicated that a student's future plans—probable field of study in college, probable career choice, highest degree sought, expectations about getting married during or after college, and concern about finances—had only modest predictive power for college achievement.[47]

Overall, Astin's research provided evidence that four student characteristics improved the predictive validity of freshmen grade point average (GPA) when sex, high school grades, SAT/ACT, and college selectivity were controlled: (1) membership in a scholastic honor society; (2) attendance at a private high school; (3) high self-rating on academic ability; and (4) high self-rating on drive to achieve.[48]

Astin's work also focused on the prediction of drop-out behavior in college students.[49] He found that the males who (1) were older than average, (2) were seeking less than a bachelor's degree on admission, (3) reported "some chance" of getting married while in college, (4) attended public high school, (5) majored in physical science, (6) were a religion other than Protestant, (7) frequently overslept and missed classes or appointments, and (8) turned in papers late, were more likely to drop out of college.[50]

Astin found many of the same variables to be predictive of female drop-out behavior.[51] By contrast, however, the females most likely to drop out of college were those who had major concerns about finances on admission to college, were non-white, had no religious preference, and did not win a varsity letter in high school.[52]

According to the U.S. Department of Education, the "higher a students' socioeconomic status (SES), the more likely that student was to transfer to a four-year institution: 35 percent of high SES students transferred compared to 21 percent of middle SES and 7 percent of low SES students."[53]

Tinto's research also indicated that "individuals of different race, ability, and social status origins differed markedly in the rate at which they left higher education within four years of entry without earning a college degree."[54] Tinto used variables such as student "intention" and "commitment" as predictors of student success because he considered these to be the "primary roots" of departure from higher education.[55] Tinto

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also found that individual attributes such as sex, age, ethnicity, expected major, and marital status, had predictive validity.[56]

Tinto's earlier work focused on what he termed *academic* and *social integration*.[57] A student's average undergraduate grades and membership in a scholastic honor society measured *academic integration*, which Tinto found to be highly predictive of student success.[58] *Social integration,* a student's involvement with peers and faculty, was defined by how well the student knew a professor or administrator, whether the student was president of one or more student organizations, had a major part in a play, won a varsity letter, or edited a school publication.[59]

Definition of Terms

A **performance indicator**, for the purposes of this paper, was "a numerical value which provid[ed] a measurement for assessing the quantitative performance of a system."[60]

Performance budgeting and **performance funding,** though similar in method and implication, had several distinctions. According to the National Council for Research and Planning (NCRP), performance ***budgeting*** was: "the subjective practice that [took] into account various areas of performance in determining an institution's overall appropriation and [let] state officials retain discretion over how much to alter the college's bottom line."[61]

Performance budgeting, according to Burke, was when "state governments or coordinating boards consider[ed] institutional performance, usually based on a longer list of indicators, as a general context when determining the total budgets of public colleges and universities."[62] Burke and Serban added: "performance budgeting considers results

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of performance indicators as a factor in the total funding of public colleges and universities."[63] With performance budgeting, there was a flexible and discretionary but unclear link between performance indicators and allocated funding.[64]

Performance funding, according to the National Council for Research and Planning (NCRP), "use[d] a formula to determine how much to give a college that ha[d] met a prescribed goal or specified standards of performance."[65] Burke and Serban put it another way: "performance funding ties special sums directly to results of specific indicators."[66]

Outcomes measures were such things as graduation rates, transfer rates, mean income of alumni five years after graduation, student satisfaction measures, student test scores, and other variables focusing on the end product of a student's educational experience.

Institutional graduation rates, for this study, equaled the percentage of students completing a degree or certificate program within a specific period of time.

Transfer rates required the accurate tracking of students from one institution to another.[67] According to the U.S. Department of Education, transfer "[did] not imply transfer of credit . . . it simply characterize[d] observed transitions between institutions. For transfer to a less-than-four-year institution, any transition that was not followed by a return to the first institution constitute[d] a transfer. For transfer to a four-year institution, any entry into a four-year institution constitute[ed] a transfer, regardless of subsequent enrollment at the institution of origin."[68] In addition, "students were only classified as transfers if they changed institutions permanently without returning to the original institution."[69] This definition excluded students who "were enrolled at two institutions simultaneously, attended summer school at a different institution, or were enrolled temporarily at a second institution and then returned to the first one."[70]

The **residual**, as used in this study, meant the difference between the predicted graduation and/or transfer rate at an institution and that institution's actual graduation and/or transfer rate.

Predictors, as used in this study, were variables that correlated with the graduation and/or transfer behavior of postsecondary college students five years after beginning their college careers.

Notes

[1] Alexander W. Astin, "College Retention Rates Are Often Misleading," *Chronicle of Higher Education,* 22 September 1993, A48.

[2] *Ibid.*

[3] E. Pascarella, John C. Smart, and Corinna A. Ethington, "Long-Term Persistence of Two-Year College Students," *Research in Higher Education* 24, no. 1 (1986): 48.

[4] For example, Alexander W. Astin, *Predicting Academic Performance in College: Selectivity Data for 2300 American Colleges* (New York: Free Press, 1971).

[5] For example, Vincent Tinto, *Leaving College: Rethinking the Causes and Cures of Student Attrition* (Chicago: University of Chicago Press, 1987).

[6] For example, Jill Johnes and Jim Taylor, *Performance Indicators in Higher Education* (Buckingham, England: Open University Press, 1990).

[7] Thomas G. Mortenson, "Actual vs. Predicted Institutional Graduation Rates for 1100 Four-Year Institutions," *Postsecondary Education Opportunity* (April 1997).

[8] According to the National Center for Education Statistics, about 45 percent of first-time undergraduates attend public two-year colleges. U.S. Department of Education, National Center for Education Statistics (NCES), *1990 Beginning Postsecondary Students Longitudinal Study* (BPS:90/94) and *1995-96 National Postsecondary Student Aid Study* (NPSAS:96).

[9] U.S. Department of Education, BPS:90/94 and NPSAS:96.

[10] Pascarella, Smart, and Ethington, "Long-Term Persistence."

[11] According to Levine, "fewer than one in six of all current undergraduates fits the traditional stereotype of the American College student: eighteen to twenty-two years of age, attending full-time, and living on campus." Arthur Levine and Jeanette S. Cureton, "What We Know about Today's College Students," *About Campus* (March-April 1998): 4.

[12] According to McCabe and Day, among entering community college students, 87 percent require remediation—a fact that makes the standard six-year graduation rate a poor measure of community college performance. Robert H. McCabe and Phillip R. Day, Jr., *Developmental Education: A Twenty-first Century Social and Economic Imperative* (Laguna Hills, CA: League for Innovation in the Community College, 1998), 27.

[13] According to McCabe and Day, "a majority of [community college] students enroll to gain specific skills and are not seeking a degree" and "many enroll only for specific short-term objectives," *ibid.*, 28, 31.

[14] U.S. Department of Education, BPS:90/94 and NPSAS:96.

[15] McCabe and Day, *Developmental Education,* found that "virtually all [community college] students work and attend classes part time" (28); in addition, "policy makers, outside analysts, and the media . . . may use inappropriate criteria for evaluating community college success . . . [because of] the central false assumption . . . that a two-year degree program should be completed in two years" (31).

[16] U.S. Department of Education, BPS:90/94 and NPSAS:96.

[17] McCabe and Day point out in *Developmental Education* that as postsecondary enrollments increase the number of under-prepared students grows proportionately. (27).

[18] U.S. Department of Education, National Center for Education Statistics (NCES), *The Condition of Education 1998* (NCES 98-013) (Washington, D.C.: 1998), 25.

[19] According to the National Center for Education Statistics, 61.6 percent of the BPS:90/94 cohort (who began their college careers at two-year institutions in 1989-90) had not obtained a degree by the spring of 1994. In comparison, 39.6 percent of those beginning at four-year institutions had not obtained a degree by the spring of 1994. In addition, 75.8 percent of those students in the BPS:90/94 cohort who began college at a two-year institution were white, while 82.7 percent of the four-year college cohort were white. U.S. Department of Education, National Center for Education Statistics (NCES), *Descriptive Summary of 1989-90 Beginning Postsecondary Students: Five Years Later* (NCES 96-155) (Washington, DC: May 1996), 3, 15.

[20] Alexander W. Astin, *Predicting Academic Performance in College; Selectivity Data for 2300 American Colleges* (New York: Free Press, 1971); Alexander W. Astin, *Four Critical Years: Effects of College on Beliefs, Attitudes, and Knowledge* (San Francisco: Jossey-Bass, 1977); Alexander W. Astin, "Financial Aid and Student Persistence," *HERI Research Report Series* 75, no. 2 (Los Angeles: Higher Education Research Institute, n.d.); Alexander W. Astin, *Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education* (Phoenix: Oryx Press, 1993); Alexander W. Astin, *What Matters in College? Four Critical Years Revisited* (San Francisco: Jossey-Bass, 1993); Tinto, *Leaving College.*

[21] SAT scores and on-campus housing, for example, are often inappropriate indicators for the community college sector because many of these students do not take the SAT, and most community colleges do not offer on-campus housing.

[22] Astin, *Predicting Academic Performance*; Astin, *Four Critical Years*; Astin, "Financial Aid and Student Persistence;" Astin, *Assessment for Excellence*; Astin, *What Matters in College?*; Tinto, *Leaving College.*

[23] Jill Johnes and Jim Taylor utilized predictive models for this purpose in their work: *Performance Indicators in Higher Education.* Thomas G. Mortenson also utilized predictive models of student graduation to rank four-year colleges and universities in the United States, in "Actual vs. Predicted Institutional Graduation Rates for 1100 Four-Year Institutions," *Postsecondary Education Opportunity* (April 1997).

[24] Mortenson, "Actual vs. Predicted Institutional Graduation Rates."

[25] Johnes and Taylor, *Performance Indicators in Higher Education.*

[26] For instance, in "Actual vs. Predicted Graduation Rates," Mortenson found that student characteristics such as family income, parental educational attainment, and student motivation could be held constant for all institutions, thus creating a more accurate comparison across institutions.

[27] Pascarella, Smart, and Ethington, "Long-Term Persistence of Two-Year College Students."

[28] According to the study Beginning Postsecondary Students 1990-1994 (BPS:90/94) (National Center for Education Statistics), 56.5 percent of the students who began their college education at a two-year institution attended more than one institution of postsecondary education during the five years of the study. Clifford Adelman, *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment* (Washington, D.C.: U.S. Department of Education, 1999), 43.

[29] *Ibid.,* 45.

[30] Using the National Center for Education Statistics: High School and Beyond/Sophomore cohort 1982-1993, Clifford Adelman found that students who began college at the community college-level were more likely to attend three or more postsecondary institutions than were students who began at any other type of referent first institution (excluding doctoral institutions, where the same percentage of students attended three or more institutions than did community college students). *Ibid.*

[31] U.S. Department of Education, BPS:90/94.

[32] See note 20 above.

[33] *Ibid.*

[34] *Ibid.*

[35] *Ibid.*

[36] U.S. Department of Education, NPSAS:96.

[37] U.S. Department of Education, BPS:90/94.

[38] *Ibid.*

[39] Regression analysis is a commonly used method for conducting predictive studies. Alexander W. Astin and Vincent Tinto used this methodology in their research on the subject. Astin, *Four Critical Years*; Astin, "Financial Aid and Student Persistence;" Astin, *Assessment for Excellence*; Tinto, *Leaving College.*

[40] Astin and Tinto, specifically. Also used were variables from the work of Johnes and Taylor, *Performance Indicators in Higher Education.*

[41] Astin, *Four Critical Years*; Astin, "Financial Aid and Student Persistence;" Astin, *Assessment for Excellence*; Tinto, *Leaving College*.

[42] Johnes and Taylor, *Performance Indicators in Higher Education*, 89.

[43] *Ibid.*, 89-92.

[44] Astin, *Predicting Academic Performance;* Astin, *Four Critical Years*; Astin, *Assessment for Excellence*.

[45] *Ibid.,* 13.

[46] *Ibid.*, 14.

[47] *Ibid.,* 275.

[48] *Ibid.,* 13.

[49] *Ibid.*

[50] *Ibid.*, 19.

[51] *Ibid.*

[52] *Ibid.*

[53] U.S. Department of Education, *The Condition of Education 1998,* 54.

[54] Tinto, *Leaving College*, 26.

[55] *Ibid.,* 37.

[56] *Ibid*, 78-85.

[57] Vincent Tinto, "Dropout from Higher Education: A Theoretical Synthesis of Recent Research," *Review of Educational Research* 45 (1975): 89-125.

[58] *Ibid.*

[59] *Ibid.*

[60] Robert Ball and Rob Wilkinson, "The Use and Abuse of Performance Indicators in UK Higher Education," *Higher Education* 27, n. 4 (June 1994): 418.

[61] National Council for Research and Planning (NCRP), "Performance-based Funding and Budgeting," *NCRParameters* (October 1998): 1.

[62] Joseph C. Burke, "Performance Budgeting and Funding: Making Results Count Where It Matters," *Assessment Update: Progress, Trends, and Practices in Higher Education* 10, no. 6 (November/December 1998): 2.

[63] Joseph C. Burke and Andreea M. Serban, "Performance Funding: Fad or Emerging Trend," *Community College Journal* (December/January 1997-98): 27.

[64] Burke, "Performance Budgeting and Funding," 2.

[65] NCRP, "Performance-Based Funding and Budgeting," 1.

[66] Burke and Serban, "Performance Funding," 27.

[67] U.S. Department of Education, *The Condition of Education 1998*, Supplemental Note for Indicator 11.

[68] *Ibid.*

[69] U.S. Department of Education, NCES 96-155, 7.

[70] *Ibid.*

CHAPTER 2
POSTSECONDARY EDUCATION FUNDING

Community College Funding

History of Community Colleges

Since the inception of community colleges in 1901, these institutions have been highly adaptive to changes exerted by external forces.[1] The enormous growth of these institutions during the twenty-five years following World War II resulted in a tripling of the number of community colleges to nearly thirteen hundred institutions.[2] Campbell reported that community colleges of the decade of the 1990s, initially extensions of the public high school system, ranged "from comprehensive community college districts and systems to two-year campuses of universities to vocational-technical colleges," and enrolled half of all beginning college students.[3]

Two landmark reports marked the beginning and the end of the greatest growth period in community college history. The 1947 report of President Truman's Commission on Higher Education advocated free schooling through grade fourteen for all who could benefit.[4] At that time there were only 315 public junior colleges, and only 12 percent of individuals between the ages of eighteen and twenty-four were enrolled in college (four- or two-year).[5] Twenty-three years later, when the Carnegie Commission on Higher Education published *The Open-Door College*,[6] there were 847 public community colleges, and the proportion of eighteen- to twenty-four-year-olds enrolled in college had risen to 32 percent.[7]

Sources of Financial Support for Community Colleges

Change and uncertainty have marked the financial support for community colleges throughout their history. As "the largest area of state funding that [was] not constitutionally mandated,"[8] higher education funding was known as the "budget balancer."[9] In the face of competing social program needs, higher education was the largest component in state budgets that could be "readily cut or held to small increases."[10]

According to Campbell, Leverty, and Sayles, funds for higher education in the decade of the 1990s came from five major sources: the federal government, state government, local government, tuition and fees (combined), and other sources.[11] In 1996, for example, Cohen and Brawer reported that the distribution of funds for higher education came from five major funding sources: 46 percent from state government, 18 percent from local government, 20 percent from tuition and fees, 5 percent from the federal government, and 3 percent from other sources.[12] Clearly, state funding was the largest source of revenue for postsecondary education.

Postsecondary education's heavy reliance on state funding made it particularly susceptible to changing priorities at this level of government.[13] For example, colleges had to respond to the overall decrease in real state support for community colleges that occurred during the 1990–1995 period.[14] Decreases in state support for community colleges fueled a trend toward increased reliance on external revenue sources—such as government grants and contracts—and away from core state and local funding for basic college operations.[15]

Performance Assessment for the Allocation of Funds to Community Colleges

Input-Based Funding as Precursor

According to Burke, public colleges and universities were traditionally funded through formulas that relied on "current costs, student enrollments, and inflationary increases."[16] Funding for community colleges often depended on enrollment figures—such as full-time equivalent student measurements (FTEs)—to dictate the amount of state funds allocated per institution. Because they focused on variables that were, for the most part, out of the control of the institution, Burke called these funding approaches "input" methods of distribution.[17]

The use of "input funding"[18] was particularly popular and relatively effective during postsecondary education's high growth periods.[19] One such period was the post-World War II era during which the U.S. established the G.I. Bill,[20] allowing displaced war veterans to return to college free of charge. The resulting increase in college enrollments—the largest in U.S. history—encouraged policymakers to utilize allocations based on inputs such as enrollment-based funding.[21]

In a less affluent era shortly after the 1960s, enrollment-driven funding formulas became less useful and less prevalent.[22] With the slowing of growth in higher education, input-driven formulas met with criticism from legislative bodies and the public.[23] Palmer attributed this criticism of input-driven formulas to the fear that this funding method encouraged an "enrollment-at-all-costs attitude,"[24] often detrimental to an institution's academic viability.[25] Burke echoed the common criticism that input-driven formulas focused attention on raw numbers of enrollees while ignoring the length of time students attended an institution.[26] According to Burke, input-driven funding "neglect[ed] outputs and outcomes, such as the quantity and quality of graduates and the range and level of research and service delivered to states and society."[27]

According to Campbell, Leverty, and Sayles, input-driven funding formulas posed a particular problem for community colleges because "significant portions of the mission of these institutions [were] not associated with enrollment or credit hours."[28] The community college mission often emphasized continuing education and public service—areas that were usually sustained by self-supporting or fee-for-service funding.[29]

The Accountability Era

The decade of the 1990s saw a shift from enrollment-driven "input" formulas toward models that focused on an institution's demonstrated outcomes.[30] According to Campbell, Leverty, and Sayles, as resources declined and competition for funds increased in the decade of the 1990s, state legislatures began imposing accountability on publicly supported institutions.[31]

Prior to the decade of the 1990s, "most funding systems [for higher education] [did] not consider state educational goals, nor [did] they provide incentives for outcomes."[32] In the decade of the 1990s, state leaders began to view traditional forms of higher education funding as "obsolete, . . . insulated from state and institutional strategic planning, unresponsive to state and national priorities, and inappropriately separated from the question of value."[33]

Reasons for Performance-Based Funding and Performance-Based Budgeting

According to the National Council for Research and Planning (NCRP) "performance-based funding and budgeting represent[ed] a dramatic departure from

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traditional budgeting."[34] Changes in higher education funding followed an increased public call for accountability that moved postsecondary education to a system whereby concrete educational outcomes were defined, measured and documented.[35] In some respects, performance-based budgeting (PBB) and performance-based funding (PBF) were responses to a question posed by the Knight Higher Education Collaborative: "What would happen if an institution [was] reimbursed for its costs only to the degree that the student had demonstrated mastery of the subject?"[36]

"The idea of accountability [was] . . . the expression of a wish felt by many public officials, donors, and the general public as well—that the increasing sums laid out for public services ought to be justified by reliable estimates of the outcomes."[37] The "emphasis on outcomes . . . reflect[ed] taxpayers' desire to know their money [was] being well spent."[38]

While the demand for higher education continued to outpace public revenues,[39] and America's trust in higher education institutions continued to wane,[40] policymakers struggled to find a "logical basis for higher education funding."[41] According to Albright, "performance-based funding represent[ed] a paradigm shift. Rather than a state meeting the institution's needs, the college or university me[t] the state's needs."[42]

The literature presented five broad reasons for the advent of performance-based funding and budgeting (PBF&B): (1) a general dissatisfaction by the public and state and federal legislators with the quality of higher education; [43] (2) the alarming growth of demands by higher education institutions for financial resources relative to enrollment;[44] (3) growing student financial burdens in the form of rising tuition costs;[45] (4) the emergence of a financially savvy public that demanded returns on its investment in education;[46] and (5) trends in business-sector management practices toward the use of performance indicators (PIs) to measure performance.[47] Meritosis and Wolanin added that "shifting government policies and priorities, growing demands from consumers, and an evolving relationship with employers who rel[ied] on community colleges to provide them with skilled workers" also contributed to the move toward PBF.[48]

Waning public confidence

According to Bowen, the accountability era "reflect[ed] in part a failure of [public] confidence in many of our institutions."[49] Serban agreed that "performance funding for public higher education . . . emerged in response to . . . the public's concern for accountability and results."[50]

Criticisms of two-year and community college performance also served as an impetus for a move to accountability practices.[51] Bray and Kanter reported that outcomes assessment efforts, achieved through grassroots networks during the early 1980s, were a "response to the calls of critics who claimed community colleges were a 'revolving door' for students."[52] In California such claims resulted in the formation of an eighty-college collaboration known as the Learning Assessment Retention Consortium (LARC) in 1981.[53] According to the Knight Higher Education Collaborative, "the sad truth [was] that too many who cross[ed] the starting line never reach[ed] the finish—whether defined as the completion of a baccalaureate degree, an associate's degree, or a basic skills program."[54]

Nichols reported, "[T]he purposes of two-year colleges [were] often misconstrued by the public and by other segments of postsecondary education."[55] According to Welleri and Seybert, "Concern [was] raised about the success rate of students entering

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community colleges, as well as the ability of the colleges to move students on to the bachelor's degree."[56]

General perceptions about the value and quality of higher education also played a major role in the move toward accountability funding.[57] For example, Austin R. Gilbert, as chairman of South Carolina's Commission on Higher Education, reported in 1997 that his constituents doubted that public colleges were using their tax dollars wisely.[58] According to Gilbert, higher education institutions were "faced with a crisis in credibility."[59]

Drawing from a 1989 poll conducted to assess the quality of postsecondary education, Langfitt reported that a significant majority of respondents felt that the quality of higher education had declined over the past 10 to 15 years.[60] This sentiment was echoed throughout the literature: "[A] combination of inefficiency and perceived insensitivity on the part of the institutions toward their clients [was] at the heart of the public's disaffection with . . . higher education."[61]

Rising cost of tuition

"Financing a college education [was] a serious and troublesome matter for the American people."[62] Langfitt reported that the most common criticisms aimed at higher education were that "colleges and universities [got] all they [could] and spen[t] all they [got], that teaching assistants provide[d] much of the undergraduate education . . . [and that a] college education [was] not worth its cost."[63] The National Committee on the Cost of Higher Education reported that "rising college tuitions [were] real. In the twenty years between 1976 and 1996, the average tuition at public universities increased from $642 to $3,151."[64]

"[T]here [was] ample public criticism reflected in the media, letters from parents and alumni, and in occasional student strikes about rising costs of higher education."[65] According to Langfitt, even as early as 1976—prior to the push for PBF&B in America—the call for accountability reflected the public's frustration over rapidly increasing costs at higher education institutions.[66] Bowen concurred that "the call for accountability . . . reflect[ed] in part . . . frustration over rapidly increasing costs."[67]

Johnstone responded to this concern and its subsequent criticisms by pointing out that "tuitions [rose] faster than the rate of inflation."[68] He concluded that the general public and the media could not be expected to understand the fact that the Consumer Price Index (CPI), the gauge by which inflation was measured, was an average of price increases across goods. According to Johnstone, by virtue of being an average, one half of the goods included in this index exceeded the CPI. He reported that "tuition [would] almost always be in that above-average half."[69]

Langfitt analogized the criticisms waged at higher education's rising costs to the public perception of the health care industry in the decade of the 1980s. Langfitt described college and university finance as a "cost-plus system" whereby colleges and universities "calculate[d] . . . costs, then [sought] the revenues to cover the costs, often employing tuition and fee increases to balance the budget."[70]

According to Langfitt, public health care and higher education played similar roles in developing and maintaining the human capital "that [was] the source of national progress and prosperity."[71] Langfitt reported that both institutions experienced the same public disenchantment—"excessive costs, a perceived decline in the quality of the services, and inadequate access based mainly on costs." Langfitt added that the public's

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"dissatisfaction with colleges and universities . . . [was] on the rise—mainly focused on cost increases in tuition and fees considerably in excess of general inflation."[72]

Business-oriented models as precursors

PBF&B also resulted from the evolution of resource allocation and management methods in the private business sector.[73] According to Alfred and Carter, emerging community college management practices were "similar to management innovations in for-profit organizations".[74]

Process-oriented evaluation methods, such as Continuous Process Improvement (CPI) and Total Quality Management (TQM), contributed to the development of performance-funding methods.[75] The influences of CPI and TQM were most prevalent in PIs that focused on the "improvement of services to students."[76] Research conducted by Dooris and Teeter, for example, illustrated that PIs could be effectively derived from quality improvement methods such as TQM and CPI.[77]

Postsecondary administrators and faculty challenged the applicability of CPI and TQM to higher education, because these business-oriented methods employed language unfamiliar to and often conceptually inappropriate for the education sector.[78] Borden and Banta pointed out that the use of the phrase "'customer satisfaction' [was] not generally accepted as an appropriate focus for classroom and curricular development,"[79] despite the fact that "most legislators [said] they want[ed] higher education to operate more like a business."[80]

Call from legislative and budgetary bodies and decreased tax support

Other factors that contributed to the call for accountability in higher education included declining resources, increased competition for funding (especially in those states

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experiencing rapid growth in their school- and college-age populations), and an overall paradigm shift among legislative bodies.[81] For these reasons "[l]awmakers [were] reluctant to spend more on higher education."[82] This hesitation resulted in a dwindling of the funds once earmarked for higher education.[83]

Langfitt reported in 1986 that federal government contributions to higher education revenues were down 2 percent from 1976 levels.[84] In California the "declining resources caused by state response from the legislature and the California Community Colleges Board of Governors" were a key reason for the "vigorous oversight of funds allocated to community colleges."[85] California used assessment of outcomes as a tool for distributing scarce state resources to those institutions that "demonstrate[d] educational quality, efficiency, and effectiveness."[86]

Borden and Banta also recognized increasing demands for public funds.[87] According to these researchers, competition for state funds grew dramatically in the decade of the 1990s, and, as a result, "higher education saw its support diminish as health care, care for the aged, and penal system demands increased."[88] Increased demand for financial resources relative to enrollments caused some states to move toward student outcomes assessment programs.[89] In the United Kingdom and other European countries, the development of higher education PIs was due almost completely to political pressures for funding priorities and accountability.[90]

There was also a general shift in the way legislators thought about public higher education.[91] Despite the possible cause of policymakers' concerns, there was a "clear need for academics to address decision makers' needs for accountability data if the

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provision of resources to support those improved programs [was] to continue in the future."[92]

A more sophisticated public

A greater societal knowledge of economics and finance was another source of the increased demand for performance assessment of institutions: "[The general public] was more knowledgeable about national and global economic issues due to intensive media coverage . . . and manage[d] their personal financial affairs with more care."[93] In return, society was placing ever-greater demands on higher education to adequately prepare students for the modern workplace.[94] Ball and Wilkinson reported that higher education was simply part of a greater move towards a "performance oriented culture"—a "society striving for 'value for money.'"[95]

Other groups, such as the National Council for Research and Planning (NCRP), reported that the availability of performance outcomes information and the need for better and more flexible service delivery were other factors contributing to the move toward PBF&B for higher education.[96]

In the end, the call for accountability necessitated a "definition of costs as a function of what [was] done and how it [was] done," and resulted in a "process of consensus building among the primary constituencies: policy makers, administrators, faculty, students and the public."[97] This consensus-building, as Brown pointed out, was "often difficult because each evaluator approache[d] the university with his own special concerns, his own constituencies, his own prejudices, and his own objectives."[98]

Status of Performance Funding and Performance Budgeting in the Late 1990s

In 1979, Tennessee was the first state to adopt a performance funding program to assess the progress of publicly funded higher education.[99] With the exception of Tennessee, the states that originally used performance funding began their programs in the first half of the decade of the 1990s.[100] By 1997, Arkansas,[101] Colorado,[102] Florida,[103] Kentucky,[104] Minnesota,[105] Missouri,[106] Ohio,[107] South Carolina,[108] and Tennessee[109] were using performance-based funding or budgeting methods.[110]

Incongruity in the Literature

The literature on state participation in performance funding and budgeting was inconclusive. Two possible reasons for the literature's incongruity were the lack of standardized definitions for performance funding and budgeting, and the erratic nature of state participation in this form of funding.

Because the definitions of PBF&B varied slightly throughout the literature, researchers drew differing conclusions about state participation in this type of funding. The NCRP, for example, defined performance *budgeting* as "the subjective practice that [took] into account various areas of performance in determining an institution's overall appropriation and [let] state officials retain discretion over how much to alter the college's bottom line."[111] On the other hand, the NCRP defined performance *funding* as a system that "use[d] a formula to determine how much to give a college that . . . met a prescribed goal or specified standard of performance."[112] Because the differences between performance funding and budgeting were often misunderstood, reporting errors occurred at the state and institutional level.[113]

The incongruity in the literature about state participation in performance funding and budgeting was also due to states' ever-changing participation in these programs. For example, a survey conducted by the Rockefeller Institute of Government in 1997 indicated that ten states used performance funding; eight were likely to continue using this funding method; and seventeen states, along with the District of Columbia, were "likely to adopt it over the following five years." [114] Serban reported that eleven states used performance funding in 1998.[115] Only four months later, the NCRP reported, "[O]ver half of the states base[d] some of their allocations on the campuses' performance," and "all but five states indicate[d] they [were] likely to do so within five years."[116] In another report from July of 1998, the State Higher Education Executive Officers (SHEEO) reported that "over 40 percent of the states use[d] performance measures in the budgetary process in some manner."[117]

In October 1998, the NCRP reported that fourteen states used PBF, as defined by that organization.[118] At that time, twenty-one states used performance budgeting, which "[took] into account various areas of performance in determining an institution's overall appropriation and let state officials retain discretion over how much to alter the college's bottom line."[119]

Table 2-1 and Table 2-2 list the states that were likely to adopt, had already adopted, and were likely to continue performance funding and performance budgeting in early 1998, according to Burke and Serban.[120] Arkansas's discontinuance of its program was due in part to "a perception that two-year colleges did not receive their fair share of total state funding for higher education."[121] Burke and Serban reported that Tennessee[122] and Missouri,[123] among others, appeared to have committed themselves to this practice

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for the long term.[127] According to Albright's 1998 report, both Arkansas[131] and Kentucky[132] abolished their programs in 1997.[133]

Portion of Budget Allocated through PBF and PBB

The amount of money appropriated for PBF&B to public colleges varied from state to state. South Carolina, for example, signed Act 359 into law in the spring of 1996, which made it the first and only state to plan to base all of its appropriations for higher education entirely on how well an institution performed. [134] South Carolina's plan included allocating its entire budget for higher education based on performance by the year 2000.[135]

Table 2-1. Performance Funding for Public Higher Education in 1998.

States Likely to Adopt Performance Funding	**States That Have Adopted Performance Funding**	**States Likely to Continue Performance Funding**
Alaska	Colorado	Colorado
District of Columbia	Connecticut	Florida
Illinois	Florida	Minnesota
Indiana	Kentucky	Missouri
Louisiana	Minnesota	Ohio
Maine	Missouri	South Carolina
Maryland	Ohio	Tennessee
Massachusetts	South Carolina	Washington
Nebraska	Tennessee	
Nevada	Washington	
New York		
North Dakota		
Oregon		
South Dakota		
Texas		
Utah		
West Virginia		
Wyoming		

Source: Joseph C. Burke and Andreea M. Serban, "Performance Funding: Fad or Emerging Trend?" *Community College Journal* (December/January 1997-1998): 28.

Table 2-2. Performance Budgeting for Public Higher Education in 1998.

States Likely to Adopt Performance Budgeting	**States That Have Adopted Performance Budgeting**	**States Likely to Continue Performance Budgeting**
Alaska	Alabama	Alabama
Arizona	Florida	Florida
District of Columbia	Hawaii	Hawaii
Georgia	Idaho	Idaho
Indiana	Kansas	Rhode Island
Louisiana	Nebraska	Texas
Maine	Rhode Island	
Massachusetts	Texas	
Minnesota		
Montana		
New Jersey		
North Carolina		
Oregon		
South Carolina		
Utah		
Washington		
West Virginia		
Wyoming		

Source: Joseph C. Burke and Andreea M. Serban, "Performance Funding: Fad or Emerging Trend?" *Community College Journal* (December/January 1997-1998): 28.

Most states, however, tied only small portions of their budgets to performance measures. Schmidt reported that it was usually less than ten percent of the budget.[139] Although the funds may have been only a small portion of the total budget, the discretionary nature of these funds made them increasingly attractive and a strong financial incentive for improvement.[140] Burke and Serban agreed that small sums of money were just as effective as large sums in creating change in higher education. [141]

Measures of Institutional Performance

The success of PBF&B relied heavily on the development of accurate PIs to allocate the level of funding an institution received.[142] Without the "adoption and pursuit of appropriate indicators," decisions might have been made which "conflict[ed] with institutional policies."[143] PIs came in many different forms, were developed by many different constituencies, and were used in many different ways. Variety was the key to capturing the diversity of the nation's postsecondary institutions.[144]

Definition of Performance Indicator

Much of the literature on PIs failed to address the actual definition of the term.[145] In 1987, Cuenin defined PIs as "numerical values which provide[d] a measurement for assessing the quantitative performance of a system."[146] In response to the creation of inaccurate PIs, Elton wrote cynically: "Whatever is easily measurable becomes a PI."[148]

Three Types of Performance Assessment

Outcomes assessment, although an important part of PBF and PBB, was not the only type of assessment conducted at most institutions.[149] PIs came in three basic forms: input, process, and output indicators.[150]

Input indicators

Input indicators focused on such things as student enrollment, average SAT score of entering freshmen, and number of books in the library.[151] Heavily relied upon during postsecondary education's high growth period from the late 1950s to the decade of the 1970s, input indicators reflected the first component of the institutional performance equation.[152] During this high growth period, funding allocations for higher education relied primarily on full-time student enrollment figures, which were relatively easy to calculate.[153]

One problem with focusing performance measurement on the inputs of postsecondary education was that inputs were given the "highest importance, followed by efficiency and then effectiveness."[154]

Process indicators

Process indicators focused on the actual delivery of educational services,[155] "represent[ing] behaviors associated with desired outcomes of college and estimat[ing] the extent to which students . . . engaged in these activities."[156] Process indicators included such measures as the quality of general education course delivery, the length of waiting lists for required courses, faculty evaluations, and the "amounts of money, time, and human resources that [were] allocated to organizational units and endeavors."[157]

Burke and Serban reported that the reason more than 40 percent of state-selected PIs were process indicators was because many indicators that focused on the outputs of higher education were difficult to quantify.[158] In addition, Kuh, Pace, and Vesper reported that "process indicators . . . [were] less difficult and expensive to develop and administer compared with most outcomes assessment instruments."[159]

Outcomes indicators

Although input (or resource) indicators received much attention throughout the decade of the 1970s, "the 1980s saw a groundswell of interest in the other side of the ledger: outcomes."[160] Serban noted that the PIs of the decade of the 1990s "reflect[ed] a shift of performance funding from the resources needed by higher education to the results produced."[161]

Burke and Serban reported that other outcomes indicators included such things as student transfers, time-to-degree, teaching loads, licensure test scores, and job placement indicators. A survey of state and campus leaders showed that respondents considered retention and graduation rates, job placement, licensure exam scores, and employer surveys the most appropriate PIs.[162]

In many ways, Tennessee led the movement for reporting outcome information about postsecondary institutions.[163] "Following the advent of performance funding in Tennessee, which specified that institutions would gather detailed [outcome] information . . . three-quarters of the states adopted polices that caused public colleges and universities to collect and report some kind of outcome information."[164] This system, which held colleges and universities accountable, required that "institutions identify and measure the outcomes or products or effects of higher education and then compare the results with the costs."[165] While varying forms of performance assessment techniques existed around the country, only outcomes assessments had been widely adopted by state and local educators.[166]

Benchmarking

In the decade of the 1990s, benchmarking became a popular way for institutions to evaluate their own performance relative to that of state and national peer institutions and to their own past performance.[167] However, because it was preferable for institutions to choose PIs closely aligned with their individual missions, a question arose as to the "validity of using PIs to compare institutions."[168]

Ball and Wilkinson worried that "indicators for comparative purposes might destroy diversity."[169] These researchers reported that any attempt to use PIs uniformly across institutions was likely to impede the original purpose of this type of measurement—to achieve institutional excellence.[170] In 1989, Page summarized the problem this way: "[P]erformance indicators [were] invaluable . . . tools of management information within institutions; they [were] misleading and unhelpful tools of political analysis between institutions—unfortunately the latter [were] more exciting."[171] Mingle considered benchmarks inappropriate for assessing the performance of higher education institutions, since "benchmarks such as high graduation or pass rates reveal[ed] little about how such feats were achieved."[172]

To remedy this problem, Ball and Wilkinson developed what they termed "macro-indicators."[173] These indicators "relate[d] only to the overall system and not to individual institutions within the system."[174] Because a degree of public accountability was necessary when talking about publicly funded entities, macro-indicators included such things as "scale and effectiveness, level of resourcing, efficiency and source of funds."[175]

A less traditional use of benchmarking—as a means of establishing self-imposed "markers" of good performance—became more popular in the early 1990s.[176] For example, in 1992, Tennessee moved from five to ten performance funding indicators and added several criteria that rewarded institutions for improvement against their own benchmarks on locally developed goals.[177] Benchmarking was seen as a way to "contextualize" what would otherwise have been absolute measures of institutional performance.[178]

Number of Indicators Used

The number of PIs used for postsecondary institutional assessment varied from state to state. According to Burke and Serban, the number of indicators used within

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states ranged from five to thirty-seven, although the numbers averaged around seven to sixteen.[179]

Perceptions about the similarity of PIs used by states varied throughout the literature.[180] Some research, such as the Rockefeller Institute's November 1996 state survey, reported great variation in states' choices of PIs.[181] The NCRP also noted a great variation from state to state in the number of indicators used.[182] However, two indicators were used in almost all state performance budgeting and funding programs.[183]

The Most Common Measures of Institutional Performance: Graduation and Transfer Rates

"The most commonly used measures for performance reporting [were] primarily quantitative indicators of 'outcome' or 'output.'"[184] According to Burke and Serban, "[O]nly retention and graduation rates appear[ed] as indicators in nearly all states' programs."[185] The number of PIs used by states ranged from thirty-seven in South Carolina, to five in Minnesota, but, according to Rupert, the two most common indicators of performance used by states in 1997 were graduation and transfer rates.[186]

Even though graduation and transfer rates reflected only one component of most assessment models—individual student success—they were the most heavily emphasized assessment indicators, used in thirty-two and twenty-five states, respectively. The State Higher Education Executive Officers (SHEEO) reported that graduation rates were most commonly used for consumer information, followed by degrees awarded, admission standards, and transfer rates.[187] These measures, as with all of the most commonly used performance measures, were "primarily quantitative indicators of 'outcome' or 'output'."[188]

The Rockefeller survey found that state policymakers and postsecondary institution leaders shared a view of appropriate indicators of institutional performance.[189] Both groups agreed that retention and graduation rates, among other outcome measures, were appropriate measurements of institutional performance.[190]

Accuracy of Performance Measures

Some of the literature criticized the use of graduation and transfer rates as indicators of institutional effectiveness.[191] A study by the National Center for Research in Vocational Education (NCRVE) presented evidence that raised doubt about the appropriateness of graduation rates as an effective indicator.[192] The NCRVE study showed that sub-baccalaureate higher education, including course work that did not result in a degree, had very significant economic benefits in certain labor market fields.[193] This finding questioned the use of graduation rates as an appropriate measure of institutional quality, since non-completers (students who did not complete a degree or certificate program) benefited from brief enrollment in higher education.[194] Put another way, the economic benefit of even some participation in postsecondary education meant that graduation rates were an inappropriate indicator of institutional effectiveness.[195]

Another criticism of the use of graduation and transfer rate indicators came from the American Association of Community Colleges (AACC).[196] The AACC cautioned that the reporting of graduation and transfer rates in isolation disregarded important aspects of student life, including student intentions and course-taking behavior.[197] The AACC suggested focusing on data reflecting student obtainment of employment with the

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benefit of some college course completion, but not necessarily the completion of a degree or certificate program.[198]

Astin's research showed that legislation such as the Student Right to Know Act,[199] which "focus[ed] entirely on student 'outcome' measures such as graduation and . . . ignor[ed] the student's original 'input,' . . . create[d] a strong disincentive for institutions to recruit under-prepared students, not to mention poor students and those from underrepresented minority groups."[200]

Varying Definitions

Even the most pervasive outcomes measures, such as retention and program completion rates, were calculated and reported differently across institutions and systems.[201] This lack of standardization in outcomes data, which made comparisons across institutions and systems virtually impossible to ascertain, reduced the utility of outcomes data for policymaking and evaluation.[202]

For example, the Center for the Study of Community Colleges (CSCC) adopted one of many possible definitions of "transfer student."[203] It defined *transfer rate* as "all students entering the two-year college in a given year who ha[d] no prior college experience and who complete[d] at least twelve college credit units within four years, divided into the number of that group who t[ook] one or more classes at a university within four years."[204] The National Center for Education Statistics (NCES), on the other hand, defined *transfer student* in their Beginning Postsecondary Students study (BPS:90/94) as a student who "changed institutions permanently without returning to the original institution."[205]

Astin agreed that "the relative 'effectiveness' of different institutions [could] be substantially affected by the particular definition of retention used."[206] Bray and Kanter pointed out that the adoption of proper measures, as well as the definition of the measures adopted, were central themes of the performance measure debate.[207]

Performance Indicator Developers

The selection of PIs and the adoption of performance funding and budgeting were subject to the interpretations of those who developed and adopted them.[208] Serban reported three ways in which performance funding could be adopted: (1) state-mandated performance funding and legislatively prescribed goals and indicators; (2) state-mandated performance funding, and higher education coordinating board-prescribed indicators; and (3) performance funding initiated by higher education coordinating bodies to prevent a governmental mandate.

In Colorado,[209] Minnesota,[210] Ohio,[211] and South Carolina,[212] for example, "legislation mandated the program and prescribed the indicators" to be used.[213] Ruppert reported that most accountability programs, as conceived in state policy, were "developed *by* state policymakers *for* state policymakers." (Emphasis added.)[214]

In other states, however, legislation mandated the initiation of performance funding programs, but left the higher education coordinating agencies and campus leaders to propose the specific PIs to be used.[215] NCRP reported that the more effective programs allowed institutions to participate in the selection of the indicators.[216]

Some states used a combination of statewide and institution-specific indicators.[217] For example, in 1997, six states set statewide indicators for use by all institutions (both two- and four-year) of which three permitted campus-specific indicators.[218]

Still other methods for deriving indicators were used in Tennessee,[219] Arkansas,[220] and Kentucky,[221] where coordinating agencies worked with institutional representatives to implement performance funding programs without legislative interference.[222] According to Burke and Serban, the means by which performance funding was initiated within a state "influence[d] the critical choices of performance indicators and their budget weights, success standards, and funding levels."[223]

Finally, California's "Partnership for Excellence"[224] was the result of the "first higher education governing board in the nation to propose a performance funding program."[225] No other Board of Governors to date had proposed a performance funding plan.[226]

Community College-Specific Performance Indicators

"Demonstrating institutional effectiveness present[d] a special set of problems for community colleges."[227] According to Walleri and Seybert, PIs were built on the four-year college and university paradigm, and "community college students often differ[ed] dramatically from traditional college students. The former [were] much more diverse in age, background, employment status, preparation, and educational objectives than their four-year-college counterparts."[228] "[M]easures of institutional effectiveness common to four-year colleges and universities . . . [were] in most cases not applicable to community colleges."[229]

Walleri and Seybert also reported that community college assessment strategies included efforts to "demonstrate institutional effectiveness, including a strong outcomes assessment component."[230] According to these researchers, other important components of an assessment strategy included: "systematic program reviews, follow-up surveys of former vocational students and their employers, follow-up surveys and senior institution transcript analyses of former transfer students, periodic evaluation surveys of college offices and services, and analyses of course retention and attrition rates and grading patterns."[231]

State Use of Two-Year College Indicators of Performance

With the exception of California,[232] Florida,[233] Missouri,[234] Colorado,[235] and Ohio,[236] by 1998 very few states had developed PIs for use specifically in the community college sector.[237] Although these states had developed community college-specific indicators, Ohio's[238] performance funding applied only to two-year colleges—the state's four-year colleges were not performance funded at that time.[239]

Although the five states noted above had developed community college-specific indicators by 1998, the use of these indicators varied. For example, Burke and Serban reported that, while Florida[240] had completely separate measures for its community and four-year college sectors at that time, several states provided only one alternate item for use in conjunction with a common set for all higher education institutions in the state.[241] Missouri[242] was one of the only states to have developed a specific set of indicators for the community college sector, which was used in conjunction with a set of indicators common to all higher education institutions.[243]

The focus of state PIs also varied. For instance, Ohio's adoption of community college-specific PIs focused on service expectations of the state, such as non-credit continuing education opportunities, partnerships with business and industry, community involvement, linkages with high schools, and student access—including affordability and convenient scheduling.[244]

California was one state that developed community college PIs.[245] A state budget signed by Governor Pete Wilson in August of 1998 earmarked $100 million for a system-wide community college accountability program—Partnership for Excellence.[246] This program included about $300 million more for California's 106 community colleges, and focused on performance outcomes including transfer, degrees and certificates, successful course completion, workforce development, and basic skills improvement.[247] Two of the five California community college indicators—transfer and graduation rates—were among the most commonly used in all states.[248]

The California plan also recognized and validated remediation as a key component of the community college mission.[249] In so doing, the plan enabled California's community colleges to adopt measures appropriate for this area of instruction.[250]

Recognizing that community college indicators of success might differ from those appropriate to four-year colleges and universities, Colorado adopted separate performance indicators for its two-year sector.[251] Colorado borrowed extensively from the American Association of Community College's (AACC) 1994 *Core Indictors of Effectiveness*.[252]

Mission-Specific Community College Indicators

Although many states did not have separate indicators for community colleges, many adopted priorities that reflected the mission of community colleges.[253] In 1998, "the Louisiana legislature approved a constitutional amendment that create[d] a fifty-college system aimed at building the state's workforce."[254] This legislation effectively made workforce development its top priority, and included separate performance-based financing formulas for two-year colleges.[255] The community college-specific formulas emphasized measures such as job placement and salary rates of graduates, and the responsiveness of colleges to industry priorities.[256]

In 1991, Florida began requiring the state's twenty-eight community colleges to report annual graduation rates, student progression, minority retention, placement rates, and minority enrollments.[257] By 1994, Florida had revamped its program of institutional evaluation by using the state community college system's mission statement as a framework.[258]

Selection of Community College-Specific Indicators

The AACC's 1994 *Core Indicators of Effectiveness* provided a widely used model for the development of community college PIs.[259] The AACC deemed the following indicators as appropriate for the community college sector:

1. Student goal attainment
2. Persistence (fall-to-fall)
3. Degree completion rates
4. Workforce placement rates
5. Employer assessment of students
6. Number and rate of transfers
7. Performance after transfer
8. Success in subsequent related coursework
9. Demonstration of critical literacy skills
10. Demonstration of citizenship skills
11. Client assessment of programs and services
12. Responsiveness to community needs
13. Participation rate in service area

Although there was a void in the literature pertaining directly to community college performance funding and budgeting, prominent researchers in this area agreed on the selection of appropriate performance indicators for this sector.[260] According to

Borden and Banta, for example, "in the area of two-year college transfer effectiveness . . . appropriate measures of performance from the institutional perspective [were] transfer rates and the performance of former students at senior institutions."[261]

Serban stressed a need to "reconsider the success criteria used to judge institutions' progress on performance funding indicators, and a desire for the use of combinations of institutional improvement over time, comparisons to peer institutions, and targeted external standards."[262]

Developing Performance Indicators

The literature on PBF and PBB underscored the controversy surrounding the misuse of performance measures.[263] "As state and federal interest in the use of indicators [grew], it [was] increasingly apparent that an indicator must be more than simply a readily calculable statistic."[264]

Albright recommended the following key principles for developing and implementing PBF&B:[265]

> Embrace a clear vision and common goals; achieve real reform through an improvement approach; connect performance funding with strategic planning; tailor the program to meet each state's culture and each institution's educational needs; promote collaboration; promote open communications and an inclusive process; expect trial-and-error periods and mistakes; begin with a pilot effort, and develop the implementation plan; before final decision making and marketing; limit the size of the budget allocated to performance funding; use measures that reflect quality and customer focus rather than numeric counts; use existing data whenever possible; to the extent possible, focus on measures within the control of the institution.[266]

Most of the suggestions regarding performance indicator development and adoption focused on two broad areas: flexibility of indicators and size of budget allocations.[267]

Flexibility: Allow for Mission Diversity

According to the NCRP, one of the challenges of designing a performance funding or performance budgeting system was in “finding measures that adequately reflect[ed] differences in institutional mission.”[268] Burke and Serban agreed that indicators common to all state higher education institutions needed to be used in conjunction with separate categories for two- and four-year institutions to “emphasize their different missions without neglecting common goals.”[269] Ball and Wilkinson also suggested a focus on mission.[270]

SHEEO reported, “[S]tandardizing state goals for diverse institutions d[id] not work; balancing system-wide goals with unique or customized goals or measures [was] a more effective strategy.”[271] SHEEO stressed that more emphasis should be placed on part-time students and workforce training[272]—common components of the community college mission.

According to Ball and Wilkinson, “Higher education institutions [were] not football teams, they ha[d] differing institutional missions and operate[d] in different environments.”[273] Mission diversity was “clearly beneficial,” since it allowed for “a range of institutions that [would] give a genuine choice to prospective students in particular and society in general.”[274]

State Use of Flexible Indicators

In California,[275] among other states, the PBF package gave college administrators “flexibility in choosing which outcomes fit their institutions.”[276] California’s plan gave individual colleges the flexibility to choose goals that matched their missions, as well as “the freedom to spend the money to achieve the goals they set for themselves.”[277]

South Carolina's state commission also allowed for mission diversity when it created four versions of its performance-based financing system with separate categories for research universities, teaching universities, technical colleges, and branches of the University of South Carolina.[278] The state commission did not, however, develop a separate category for community colleges.

Levels of Funding Allocations

The NCRP recommended tying only a small portion of the state budgets to performance funding or budgeting. It reported that the most effective programs generally tied less than 5 percent of the college's budget to performance budgeting and funding, thereby "reward[ing] successes rather than penalizing failures."[279] Ewell concurred that "[l]inking high stakes and measured performance c[ould] have negative consequences . . . [because] if the stakes [were] high, campuses [could] start 'managing to the numbers.'"[280] Albright reported that 2 to 5 percent of appropriations could "effect meaningful change without risking major budget instability."[281]

On the other hand, defining the amount of funds allocated through performance funding and budgeting required a delicate balance. Ewell, for instance, pointed out that if the stakes were too low, they risked being ineffective in creating change.[282]

Overall, there was no prescribed balance of allocations that could be used across states and institutions. Albright pointed out that what worked well in some states might not have worked as well in others.[283] "To assume [that] any single accountability system w[ould] definitely fulfill the expectations of all of the actors . . . [was] to assume a system that [had not] been invented yet."[284]

Advantages of Performance-Based Funding and Budgeting (PBF&B)

Proponents of PBF&B pointed out several characteristics that made this funding system superior to past funding practices.[285] According to Borden and Banta, performance-based allocations were effective funding methods because they offered "explicit points of reference," whereas past methods had not.[286] According to Bray and Kanter, PBF&B offered rewards and incentives, without which postsecondary education would not have been motivated to make positive changes to improve performance.[287]

Albright reported that PBF&B provided a way for higher education to regain the support of political leadership by providing evidence of postsecondary education's quality.[288] Similarly, the NCRP reported that performance funding served as an incentive for improved performance; responded to calls for accountability; connected plans with budgets; improved the image and credibility of colleges and universities; improved postsecondary education's communication with political leaders; and was more effective than considering only inflation and enrollment growth in funding decisions.[289]

Performance measures served both budgetary and institutional planning purposes. According to Ball and Wilkinson, PIs "provide[d] a more coordinated and integrated approach to institutional decision making."[290] "[P]erformance measures [were] used to: eliminate programs; reduce the size of programs; focus on outcomes rather than inputs; clarify state priorities; emphasize important state educational goals; provide better accountability information; assess the effective utilization of resources; link budgeting with planning and programming; promote improvement; reinforce existing quality; promote assessment; and encourage institutional change."[291]

Problems with PIs and Performance-Based Funding and Performance-Based Budgeting (PBF&B)

Performance funding was called "one of the most controversial policies of the 1990s," due to the difficulty of selecting of appropriate PIs.[292] In most cases, PBF&B were not at the heart of the controversy; usually the selected PIs and their interpretations fueled the debate. Burke and Serban reported that the "selection of performance indicators and success standards, and protection of mission diversity [were] seen as the major difficulties associated with performance funding."[293]

Clarity of purpose

PIs should have included a clear definition of whether the levels should go up or down to indicate the desired level of performance.[294] For example, problems occurred when colleges were evaluated on conflicting indicators such as SAT scores and accessibility. Although high SAT scores indicated institutional success, accessibility necessitated lower SAT entrance requirements.[295]

Subjective development

According to Banta and Borden, "Whoever determine[d] the performance indicators determine[d] the activities and direction of the system, institution, or program."[296] In 1997, for example, the chairman of the South Carolina Council of Public College and University Presidents reported that "institutions [were] at the mercy of legislative leaders who [knew] little about higher education and [did] not appreciate how difficult it [was] to define, much less measure, what a 'good' public college [did]."[297]

Counterproductive use

PIs could have become incentives for counterproductive actions.[298] For example, reporting requirements under the Student-Right-to-Know Act and the National Collegiate Athletic Association (NCAA) focused on six-year graduation rates among cohorts of entering freshmen in four-year institutions.[299] This may have provided an incentive for colleges and universities to change their admissions requirements and programs simply to improve their level of performance on this particular indicator, despite what it might have done to other areas of non-measured performance.[300]

Oversimplification

There was also a danger of oversimplification or taking a reductionist approach—reducing one's goals to what one could measure. Ruppert reported that indicators should "reflect goals and purposes" and not just be collected "because the data [was] available."[301] Despite the danger of oversimplification, much of the literature agreed that the PI approach was appropriate, because the "higher education process [was] one of transforming inputs into outputs having a higher value."[302]

Mission inconsistency

According to Schmidt, "Many institutions [were] afraid that they [would] immediately begin losing millions of dollars to a system that [was] biased against them or fail[ed] to take into account their unique character and needs."[303] This could have presented a problem for institutions whose missions were more oriented toward part-time, older, or working students, who had been characterized as higher education's "new majority."[304] The NCRP agreed that finding measures to adequately reflect differences in institutional mission was difficult.[305]

Measurement difficulties

Bowen noted that "outcomes [were] extremely hard to isolate and measure."[306] According to the NCRP, "addressing the complexities of measuring quality, particularly student learning," posed a particular problem for postsecondary use of PBF and PBB.[307] "[M]any academics believe[d] that the most important outcomes of education [were] simply not measurable."[308]

There was little agreement about which outcomes were important or how they should be measured.[309] "The time and effort involved in designing the measures, collecting the relevant data, and analyzing the results [were] so great as to discourage most investigators from tackling the problem."[310] Ruppert pointed out that many PIs did not take into account what the student wanted or expected from higher education.[311] Despite Ruppert's emphasis on the importance of knowing what students thought and wanted, student input in the development of PIs at the state level was scarce.[312]

Instability

The yearly budget cycle and the turnover of state legislators created an environment of instability for most public universities and colleges. The NCRP reported that the maintenance of institutional autonomy with state-level control, and the adjustment to annual changes in legislative priorities presented unique challenges.[313] Serban echoed these concerns.[314]

The Future of Performance-Based Funding and Performance-Based Budgeting (PBF&B)

Langfitt warned that "higher education [was] losing public trust, and [the institutions] must either . . . respond more effectively to their publics or . . . face even more government intervention in their affairs."[315]

Banta reported that most faculty "resent[ed]" externally imposed performance measures, and "believe[d] they [would] eventually go away."[316] A survey conducted in 1997, however, revealed that "state policymakers tend[ed] to forecast a favorable future for performance funding," despite college officials' belief that it faced an uncertain future.[317]

Although much of the literature indicated that PBF&B were likely to be adopted by more states in the future, the uses of the PIs appeared to be shifting.[318] For example, the current and future use of PIs for budgeting purposes was clearly articulated by the findings of a 1996 survey conducted by the Rockefeller Institute: "[E]xternal accountability was the . . . main purpose of performance funding . . . [however], all groups wish[ed] to see institutional improvement become the primary purpose."[319]

Toward an Input-Based Performance Indicator

Spanning decades of research, Alexander Astin produced a comprehensive body of literature dealing with the prediction of student academic success.[320] His most recent works focused on the applicability of his prior student success research to the accountability wave of the decade of the 1990s.[321] Astin reported in 1993 what other researchers agreed to be the inadequacies of absolute PIs: "[A] simple retention 'rate'

[told] us a lot more about who an institution *admit[ed]* than about how effective its retention practices [were]."[322]

This finding was analogous to the problems with other PIs that relied solely on absolute rates—graduation, completion, retention, and passing rates. Since "[i]nstitutions that admit[ed] large numbers of less-well-prepared students tend[ed] to have low retention rates,"[323] and the open-admissions policies of community colleges attracted students with lower levels of preparation, it followed that community colleges also had lower graduation rates than their four-year counterparts.

Astin's findings indicated that since "more than half of the variation in retention rates [which is directly related to graduation rates] . . . [could] be explained by [an institution's] expected retention rates, more selective institutions [would] have 'good' retention rates even if their retention programs [were] mediocre, and most non-selective institutions' rates [would] be 'poor' unless they happen[ed] to have exceptionally effective retention programs."[324] This problem, as presented by Astin, was exactly the one faced by less selective schools when absolute measures of institutional performance were used to allocate funds. Astin believed it was "unfair" to compare retention rates of different types of institutions.[325] Astin focused instead on how well institutions performed given the students they admitted.[326]

The use of retention rates as an indicator of institutional effectiveness made it necessary to take into account differences in entering student characteristics (inputs) when comparing the retention rates (outputs) of colleges and universities.[327] Using a statistical regression model, Astin demonstrated how a college with a relatively low retention rate that admitted students who were not well prepared for college-level studies could be viewed as performing better than a college with a significantly higher retention rate that had more selective admissions standards.[328]

Similarly, Mortenson utilized regression analysis to predict, among other things, the graduation rates and student persistence rates of four-year college students and institutions.[329] His work, while contributing to the large body of literature focused on four-year college student and institutional success, did not focus on the factors that contributed to the success of community college students.[330]

Although Mortenson's use of regression analysis for the prediction of student behavior followed a long history of this type of research, his use of these regression models was slightly different.[331] For instance, through his use of data from U.S. News and World Report,[332] IPEDS,[333] ACT,[334] and others,[335] Mortenson developed a basic model for the prediction of institutional graduation rates.[336]

Mortenson's regression analyses indicated that the "most important factors explaining the differences in [graduation rates] between institutions [were] the pre-college academic backgrounds students br[ought] with them when they enroll[ed] in college."[337] Specifically, high school grades and college admissions test scores demonstrated powerful effects over the "rate at which freshmen graduate[d] from their college of first enrollment as well as their time-to-degree."[338] Even when these pre-college characteristics were held constant, there was a "substantial residual in [institutional graduation rates] that remain[ed] to be explained."[339]

Through the comparison of *predicted* graduation rates (calculated from the application of institutional data to the basic regression model) to *actual* graduation rates, Mortenson concluded that "factors beyond the pre-college academic records of students influence[d] chances for graduating from college."[340] This method was called the *residual* or *input* approach to institutional performance assessment. By considering those student factors not under the control of the institution—part-time attendance patterns, race, age, number of dependents, academic goals, etc.—the difference between predicted and actual graduation rates could be "attribute[d] . . . to internal institutional factors that either foster[ed] or imped[ed] the rate at which admitted freshmen complete[d] their bachelor's studies."[341] A comparison of predicted and actual retention rates revealed that there were "environmental factors within institutions that explain[ed] supportive or non-supportive academic and social environments for student persistence and success."[342]

This method offered an "appropriate reference norm" for the developers of institutional PIs.[343] Specifically, this method was a cost-effective way to measure the extent to which "[s]ome institutions d[id] a better job with the academic material they enroll[ed]."[344]

According to Mortenson, graduation and retention rates based on raw data were inappropriate indicators of performance. Although this type of raw data was often used in the ranking of colleges and universities, "[n]ot until academic and other external environmental factors [were] controlled for [could] reasonable judgments about the institutional graduation rates be formed."[345] Mortenson warned that differences between institutions were explained largely by pre-college student variables, and that any use of this comparative data without controls for pre-college student variables was highly misleading.[346]

In 1990, Johnes and Taylor developed a method for the comparison of PIs across institutions,[347] based on the same problems with performance indicator comparability cited by Mortenson,[348] Adelman,[349] and Astin.[350] This method employed regression analysis to address some of the difficulties faced when comparing institutions of varying natures.

Of specific concern to Johnes and Taylor were the differences in non-completion rates across institutions and the corresponding assumptions based on these outcomes.[351] To address the differences in institutions, several student-related factors (such as entry qualifications) and several university-related factors (such as percentage of students taking business, social science or language programs, students living in on-campus housing, and staff/student ratio) were included in the analysis. What resulted was a basic model of non-completion rates for the institutions in the sample, a model which could be used to predict the expected level of drop out for each institution based on entry-level qualifications, subject mix, and the percentage of students living in halls of residence/on-campus housing.[352] Finally, Johnes and Taylor studied the differences between actual drop out rates and predicted drop out rates (residuals) as a measure of institutional performance.

Predictors of Student Success and Institutional Performance

A large body of research existed regarding predictors of four-year college student success. For example, Astin's years of research on four-year college student behavior uncovered variables shown to predict student success.[353] Even as early as 1971, Astin reported that high school grades, SAT scores, and student gender were strong predictors of college success.[354] His more recent works showed similar results: "[H]igh-school grades and SAT scores carr[ied] the most weight in predicting who [would] complete college."[355]

Astin's findings included the following list of predictors for freshman college grade point average—a measure of student success: (1) membership in a scholastic honor society; (2) former enrollment in a private high school; (3) high self-confidence in academic ability; and (4) high self-confidence in drive to achieve.[356] Another predictor discovered by Astin was the student's academic major; business, education, and physical education majors had lower freshman grade point averages (GPAs) than students in other fields.[357] Astin also found that student race,[358] religion (except for Jewish men, who had higher GPAs overall), and parental educational and economic status had only "very small effects on …academic achievement during the freshman year in college."[359]

Tinto's theoretical model of student persistence/withdrawal behavior,[360] which contained variables of social and academic integration, was the focus of a large body of research from the past twenty-three years.[361] Much of the subsequent research confirmed Tinto's findings that personal relationships formed between students and faculty members were strong predictors of student persistence.[362]

Adelman found that "one's life course [was] essentially determined at age eighteen, the bend in the metaphoric river at which the college admissions decision occurs."[363] He reported that, while pre-college factors were the strongest predictors of degree completion, it was "neither a test score nor a high school grade point average or class rank" that made the difference.[364] Instead, Adelman concluded that one's academic curriculum in high school—in terms of both intensity and quality level—was the strongest predictor of postsecondary education success.

Two-Year College Predictors

Within the small amount of research of this kind focused on two-year colleges and their students, Pascarella, Smart, and Ethington found that "person-environment fit [was] an important determinant of persistence in [two-year college] postsecondary education."[365] Specifically, students at two-year colleges were more likely to "persist in the pursuit of the bachelor's degree if they became successfully integrated into the academic and social systems of the last institution attended."[366] These researchers found that pre-college factors may not have been as influential in student persistence for two-year college students as they were for other cohorts.[367]

Conclusion

Performance funding and performance budgeting gained popularity during the decade of the 1990s as a credible and effective means of funding public higher education.[368] However, the growth in this type of funding generated much debate concerning both the types of PIs utilized to reflect higher education institutions' quality and the amount of state budgets to be allocated in this manner.[369] Most states that utilized performance funding or performance budgeting did not include a separate set of indicators for their community colleges.[370] This lack of differentiation between the indicators for four-year and two-year colleges created the potential for inequitable distribution of funds to higher education.[371] A model that could accurately predict the success of entering college students (specifically, graduation and/or transfer rates from a higher education institution) could be compared to actual success rates at individual institutions as a measure of institutional performance.[372] Although this type of model was developed successfully for other purposes in the literature, it could be extended to the performance funding arena.

Notes

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[78] Victor M.H. Borden and Trudy W. Banta, eds., "Activity-Based Costing Model for Assessing Economic Performance," *Using Performance Indicators to Guide Strategic Decision Making* 82 (San Francisco: Jossey-Bass, 1994): 9.

[79] *Ibid.*

[80] Sandra Ruppert, *Focus on the Customer: A New Approach to State-Level Accountability Reporting and Processes for Higher Education* (State Higher Education Executive Offices (SHEEO): July 1998), 2.

[81] According to Campbell, Leverty, and Sayles, states such as California, which grew by six million people during the decade of the 1980s and which experienced a dramatic diversification of its population, were especially in need of a funding plan tied to performance indicators. Campbell, Leverty, and Sayles, "Funding for Community Colleges," 179. See also Bray and Kanter, "Accountability through Assessment," 323.

[82] Schmidt, "Rancor and Confusion," A26.

[83] Campbell, Leverty, and Sayles, "Funding for Community Colleges," 178.

[84] Langfitt, "The Cost of Higher Education," 10.

[85] Bray and Kanter, "Accountability through Assessment," 332. See also California Education Code, sec. 84754.

[86] Bray and Kanter, "Accountability through Assessment," 332.

[87] Borden and Banta, "Activity-Based Costing Model."

[88] *Ibid.,* 81.

[89] *Ibid.,* 9.

[90] Jill Johnes and Jim Taylor, "An Evaluation of Performance Indicators Based upon the First Destination of University Graduates," *Studies in Higher Education* 14, n. 2 (1989).

[91] Burke, "Performance Budgeting and Funding," 1.

[92] *Ibid.*

[93] Langfitt, "The Cost of Higher Education," 14.

[94] Robert Ball and Rob Wilkinson, "The Use and Abuse of Performance Indicators in UK Higher Education," *Higher Education* 27, no. 4 (June 1994).

[95] *Ibid.,* 417.

[96] NCRP, "Performance-Based Funding and Budgeting," 1.

[97] D.T. Layzell and J.W. Lyddon, *Budgeting for Higher Education at the State Level: Enigma, Paradox and Ritual* (Washington, DC: George Washington School of Education, 1990), 58.

[98] David G. Brown, "Evaluating Institutions for Accountability," *New Directions for Institutional Research* 1, no. 1 (1974): xi.

[99] Tennessee Code, sec. 49-8-101.

[100] For example, Arkansas, Colorado, Florida, Kentucky, Minnesota, Missouri, Ohio, and South Carolina began their programs in the early 1990s.

[101] Arkansas Code, sec. 6-61-505.

[102] Colorado Revised Statutes, sec. 23-13-105.

[103] Florida Statutes, sec. 240.324.

[104] Kentucky Revised Statutes, sec. 164A00.620.

[105] Minnesota Statutes, sec. 135A.031.

[106] Missouri Revised Statutes, sec. 163.191.

[107] Ohio Revised Code, sec. 3354.18.

[108] South Carolina Code of Laws, sec. 59-103-30.

[109] Tennessee Code, sec. 49-8-101.

[110] Burke and Serban, "Performance Funding," 28.

[111] NCRP, "Performance-Based Funding and Budgeting," 1.

[112] *Ibid.*

[113] For additional definitions of performance funding and budgeting, refer to chapter one.

[114] Burke and Serban, "Performance Funding," 28. Higher education finance officers in fifty states, Puerto Rico, and the District of Columbia were surveyed.

[115] Andreea Serban, "The Performance Funding Wave: Views of State Policymakers and Campus Leaders," *Assessment Update* 10, no. 2 (March/April 1998): 11.

[116] NCRP, "Performance-Based Funding and Budgeting," 1.

[117] State Higher Education Executive Officers (SHEEO), *Preliminary Results from the SHEEO State Survey on Performance Measures* (July 1998), page unnumbered.

[118] NCRP, "Performance-Based Funding and Budgeting," 1.

[119] *Ibid.*

[120] Burke and Serban, "Performance Funding," 28.

[121] *Ibid.*

[122] Tennessee Code, sec. 49-8-101.

[123] Missouri Revised Statutes, sec. 163.191.

[124] Burke and Serban, "Performance Funding," 28.

[125] Arkansas Code, sec. 6-61-505.

[126] Kentucky Revised Statutes, sec. 164A00.620.

[127] Burke and Serban, "Performance Funding," 28.

[128] Schmidt, "Rancor and Confusion," A26.

[129] Andreea Serban adds that South Carolina is the exception to the rule because it is planning to base 100 percent of its budget on performance-based funding by the year 2000.

[130] Burke and Serban, "Performance Funding," 29.

[131] Arkansas Code, sec. 6-61-505.

[132] Kentucky Revised Statutes, sec. 164A00.620.

[133] Albright, *Transition from Business as Usual*, 5.

[134] South Carolina Code of Laws, sec. 59-103-30.

[135] *Ibid.*

[136] Albright, *Transition from Business as Usual*, 5.

[137] South Carolina Code of Laws, sec. 59-103-30.

[138] *Ibid.*

[139] Schmidt, "Rancor and Confusion," A26.

[140] Andreea Serban added that South Carolina was the exception to the rule because it was planning to base 100 percent of its budget on performance-based funding by the year 2000.

[141] Burke and Serban, "Performance Funding," 29.

[142] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 418.

[143] *Ibid.*

[144] Ball and Wilkinson, "Use and Abuse of Performance Indicators."

[145] *Ibid.,* 418.

[146] S. Cuenin, "The Case of Performance Indicators in Universities: An International Survey," *International Journal of Institutional Management.* 11, no. 2 (1987): 117-139.

[148] L.B. Elton, "Warning Signs," *Times Higher Education Supplement* (9 November 1987): 12.

[149] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 418.

[150] Borden and Banta, "Activity-Based Costing Model." In 1994, Ball and Wilkinson categorized performance indicators slightly differently: "internal," "external," and "operational." See Ball and Wilkinson, "Use and Abuse of Performance Indicators," 418.

[151] Borden and Banta, "Activity-Based Costing Model," 14.

[152] Campbell, Leverty, and Sayles, "Funding for Community Colleges."

[153] *Ibid.*

[154] Borden and Banta, "Activity-Based Costing Model," 15.

[155] Paul L. Dressel, *Handbook of Academic Evaluation* (San Francisco: Jossey-Bass, 1976), 186.

[156] George D. Kuh, C. Robert Pace, and Nick Vesper, "The Development of Process Indicators to Estimate Student Gains Associated with Good Practices in Undergraduate Education," *Research in Higher Education* 38, no. 4 (1997): 435.

[157] Borden and Banta, "Activity-Based Costing Model," 14-15.

[158] Burke and Serban, "Performance Funding," 28.

[159] Kuh, Pace, and Vesper, "The Development of Process Indicators," 436.

[160] Borden and Banta, "Activity-Based Costing Model," 99.

[161] Serban, "The Performance Funding Wave," 10.

[162] Burke and Serban, "Performance Funding."

[163] Tennessee Code, sec. 49-8-101.

[164] Bowen, "Evaluating Institutions," xi.

[165] *Ibid.*

[166] Serban, "The Performance Funding Wave," 10.

[167] Burke and Serban, "Performance Funding," 29.

[168] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 418.

[169] *Ibid.,* 419.

[170] *Ibid.*

[171] E.S. Page, "Management Statistics and Performance Indicators in British Universities" (paper presented at the 11th European Association for Institutional Research Forum, Trier, 27-30 August 1989).

[172] James R. Mingle, "Performance Funding Is Not the Cure-All to Accountability," *AGB Trusteeship* (November/December 1997): 2.

[173] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 420.

[174] *Ibid.*

[175] *Ibid.*

[176] Borden and Banta, "Activity-Based Costing Model," 97.

[177] Tennessee Code, sec. 49-8-101.

[178] Borden and Banta, "Activity-Based Costing Model."

[179] Burke and Serban, "Performance Funding."

[180] For example, see: Serban, "The Performance Funding Wave," 1; Burke and Serban, "Performance Funding."

[181] Serban, "The Performance Funding Wave," 10.

[182] NCRP, "Performance-Based Funding and Budgeting," 1.

[183] Ruppert, *Focus on the Customer*, 3.

[184] Ruppert, *Focus on the Customer*, 3.

[185] Burke and Serban, "Performance Funding," 29.

[186] Ruppert, *Focus on the Customer*, 3.

[187] SHEEO, *Preliminary Results.*

[188] Ruppert, *Focus on the Customer*, 3.

[189] Serban, "The Performance Funding Wave," 11.

[190] *Ibid.*.

[191] See National Center for Research in Vocational Education, *The Returns to Education and Training in the Sub-Baccalaureate Labor Market: Evidence from the Survey of Income and Program Participation 1984-1990* (Berkley: University of California); and Community College Roundtable, *Community Colleges: Core Indicators of Effectiveness: A Report of the Community College Roundtable* (Washington, DC: American Association of Community Colleges, National Center for Higher Education, 1994).

[192] National Center for Research in Vocational Education, *Returns to Education and Training.*

[193] *Ibid.*

[194] *Ibid.*

[195] *Ibid.*

[196] Community College Roundtable, *Core Indicators of Effectiveness.*

[197] *Ibid.,* 18.

[198] *Ibid.*

[199] Student Right to Know Act of 1990, U.S. Statutes at Large 104 (1990): 2381.

[200] Alexander W. Astin, "College Retention Rates Are Often Misleading," *Chronicle of Higher Education* (22 September 1993), A48.

[201] For example, the Center for the Study of Community Colleges and the National Center for Education Statistics defined 'transfer student' differently. U.S. Department of Education, NCES 96-155, B-13. See also A.M. Cohen, *Calculating the Rate of Transfer from Community Colleges to Public Universities in California: A Report to the California Policy Seminar,* Draft Report (Los Angeles: U.C.L.A. Department of Education, 1992), 7.

[202] Cohen, *Calculating the Rate of Transfer*, 7.

[203] *Ibid.*

[204] *Ibid.*

[205] U.S. Department of Education, NCES 96-155, B-13.

[206] Astin, "College Retention Rates," A48.

[207] Bray and Kanter, "Accountability through Assessment," 333.

[208] Serban, "The Performance Funding Wave," 10.

[209] Colorado Revised Statutes, sec. 23-13-105.

[210] Minnesota Statutes, sec. 135A.031.

[211] Ohio Revised Code, sec. 3354.18

[212] South Carolina Code of Laws, sec. 59-103-30.

[213] Burke and Serban, "Performance Funding," 28.

[214] Ruppert, *Focus on the Customer*, 4.

[215] *Ibid.*, 28.

[216] NCRP, "Performance-Based Funding and Budgeting," 1.

[217] *Ibid.*

[218] *Ibid.*

[219] Tennessee Code, sec. 49-8-101.

[220] Arkansas Code, sec. 6-61-505.

[221] Kentucky Revised Statutes, sec. 164A00.620.

[222] NCRP, "Performance-Based Funding and Budgeting," 1.

[223] Burke and Serban, "Performance Funding," 28.

[224] California Education Code, sec. 84754.

[225] Madeline Patton, "California Colleges Get $100 Million Boost," *Community College Times* (8 September 1998), 12.

[226] *Ibid.*

[227] Calhoun, "Implementing Institutional Effectiveness," 223.

[228] Walleri and Seybert, "Demonstrating and Enhancing Community College Effectiveness," 88.

[229] *Ibid.*

[230] *Ibid.*

[231] *Ibid.*

[232] California Education Code, sec. 84754.

[233] Florida Statutes, sec. 240.324.

[234] Missouri Revised Statutes, sec. 163.191.

[235] Colorado Revised Statutes, sec. 23-13-105.

[236] Ohio Revised Code, sec. 3354.18.

[237] Serban, "The Performance Funding Wave," 2.

[238] Ohio Revised Code, sec. 3354.18.

[239] Serban, "The Performance Funding Wave," 2.

[240] Florida Statutes, sec. 240.324.

[241] Burke and Serban, "Performance Funding," 28.

[242] Missouri Revised Statutes, sec. 163.191.

[243] Burke and Serban, "Performance Funding," 28.

[244] Missouri Revised Statutes, sec. 163.191.

[245] California Education Code, sec. 84754.

[246] *Ibid.*

[247] Patton, "California Colleges Get $100 Million Boost," 1; California Education Code, sec. 84754.

[248] *Ibid.*

[249] California Education Code, sec. 84754.

[250] Ruppert, *Focus on the Customer*, 3.

[251] Colorado Revised Statutes, sec. 23-13-105.

[252] Community College Roundtable, *Core Indicators of Effectiveness.*

[253] Ruppert, *Focus on the Customer*, 3.

[254] *Ibid.,* 12; Louisiana Constitution, art. 8, sec. 7.1.

[255] Ruppert, *Focus on the Customer*, 12.

[256] *Ibid.*

[257] Florida Statutes, sec. 240.324.

[258] *Ibid.*

[259] Community College Roundtable, *Core Indicators of Effectiveness.*

[260] For example, Borden and Banta, "Activity-Based Costing Model."

[261] Borden and Banta, "Activity-Based Costing Model," 29.

[262] Serban, "The Performance Funding Wave," 11.

[263] Borden and Banta, "Activity-Based Costing Model," 28.

[264] *Ibid.*

[265] Albright, *Transition from Business as Usual*, 16.

[266] *Ibid.*

[267] NCRP, "Performance-Based Funding and Budgeting," 3.

[268] *Ibid.*

[269] Burke and Serban, "Performance Funding," 29.

[270] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 417.

[271] SHEEO, *Preliminary Results.*

[272] Albright, *Transition from Business as Usual*, 16.

[273] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 426.

[274] *Ibid.*

[275] California Education Code, sec. 84754.

[276] Patton, "California Colleges Get $100 Million Boost," 1.

[277] *Ibid.*, 12.

[278] South Carolina Code of Laws, sec. 59-103-30.

[279] NCRP, "Performance-Based Funding and Budgeting," 1. The October 1995 newsletter added that allowing institutions to select some of their own indicators was another key to the most successful programs.

[280] P.T. Ewell, "Developing Performance Indicators for Community Colleges: Evidence from Two States," *Assessment Update* 4, no. 4 (1992): 14.

[281] Albright, *Transition from Business as Usual*, 4.

[282] Ewell, "Developing Performance Indicators," 14.

[283] Albright, *Transition from Business as Usual*, 4.

[284] Strategic Planning Associates, *California Community College Accountability: State and Local Implementation Costs* (Sacramento: California Community Colleges Chancellor's Office, 1991).

[285] For example, see Borden and Banta, "Activity-Based Costing Model, "12; and Bray and Kanter, "Accountability through Assessment," 334.

[286] Borden and Banta, "Activity-Based Costing Model," 12.

[287] Bray and Kanter, "Accountability through Assessment," 334.

[288] Albright, *Transition from Business as Usual*, 4.

[289] NCRP, "Performance-Based Funding and Budgeting," 3.

[290] Ball and Wilkinson, "Use and Abuse of Performance Indicators," 418.

[291] Albright, *Transition from Business as Usual*, 3.

[292] Serban, "The Performance Funding Wave," 11.

[293] Burke and Serban, "Performance Funding," 29.

[294] Borden and Banta, "Activity-Based Costing Model," 11.

[295] For example, Dr. Robert Alexander, chairman of the South Carolina Council of Public College and University Presidents and Chancellor of the University of South Carolina at Aiken, expressed his frustration with PIs in Schmidt, "Rancor and Confusion," A26.

[296] Borden and Banta, "Activity-Based Costing Model,"12.

[297] Schmidt, "Rancor and Confusion," A26.

[298] Trudy W. Banta and Victor M.H. Borden, "Performance Indicators for Accountability and Improvement," *New Directions for Institutional Research*, no. 82 (Summer 1994).

[299] *Ibid.*

[300] *Ibid.*

[301] Ruppert, *Focus on the Customer*, 14.

[302] Borden and Banta, "Activity-Based Costing Model," 14.

[303] Schmidt, "Rancor and Confusion," p. A26.

[304] Borden and Banta, "Activity-Based Costing Model,"12.

[305] NCRP, "Performance-Based Funding and Budgeting," 3.

[306] Bowen, "Evaluating Institutions," xi.

[307] NCRP, "Performance-Based Funding and Budgeting," 3.

[308] Bowen, "Evaluating Institutions," 24.

[309] See Ruppert, *Focus on the Customer*; Bowen, "Evaluating Institutions;" and NCRP, "Performance-Based Funding and Budgeting."

[310] Bowen, "Evaluating Institutions," 24.

[311] Ruppert, *Focus on the Customer*, 8.

[312] *Ibid.*, 14.

[313] NCRP, "Performance-Based Funding and Budgeting," 2.

[314] Serban, "The Performance Funding Wave."

[315] Langfitt, "The Cost of Higher Education," 10.

[316] "Editor's Notes: Making a Silk Purse," *Assessment Update* (March/April 1998): 3.

[317] Burke and Serban, "Performance Funding," 29.

[318] Burke, "Performance Budgeting and Funding," 2.

[319] Serban, "The Performance Funding Wave," 10.

[320] Some of Astin's work include: Astin, "College Retention Rates," p. A48; Alexander W. Astin, *Predicting Academic Performance in College: Selectivity Data for 2300 American Colleges* (New York: Free Press, 1971); Alexander W. Astin, *Four Critical Years: Effects of College on Beliefs, Attitudes, and Knowledge* (San Francisco: Jossey-Bass, 1977); Alexander W. Astin, "Financial Aid and Student Persistence," *HERI Research Report Series* 75, no. 2 (Los Angeles: Higher Education Research Institute, n.d.); Alexander W. Astin, *Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education* (Phoenix: Oryx Press, 1993); and Alexander W. Astin, *What Matters in College? Four Critical Years Revisited* (San Francisco: Jossey-Bass, 1993).

[321] For example: Astin, *What Matters in College*; and Astin, "College Retention Rates," A48.

[322] Astin, "College Retention Rates," A48.

[323] *Ibid.*

[324] *Ibid.*

[325] *Ibid.*

[326] Astin, "College Retention Rates," A48.

[327] Astin, *What Matters in College.*

[328] *Ibid.*

[329] Mortenson also studied the relationships between academic characteristics of students and persistence rates. See "Freshman to Sophomore Persistence Rates 1983 to 1997," *Postsecondary Education Opportunity* (June 1997).

[330] *Ibid.*

[331] Such as Vincent Tinto and Alexander Astin's research.

[332] *America's Best Colleges* (Washington, D.C: U.S. News & World Report, 1996).

[333] U.S. Department of Education, National Center for Education Statistics (NCES), *Integrated Postsecondary Education Data System (IPEDS94 DISC)* (Washington, D.C.: 1994).

[334] American College Testing, *College Planning/Search Book* (Iowa City: American College Testing, 1995).

[335] Mortenson uses other sources from the National Center for Education Statistics for similar research.

[336] Mortenson, "Freshman to Sophomore Persistence Rates," 1.

[337] *Ibid.*

[338] See Thomas G. Mortenson, "Institutional Graduation Rates by Pre-College Academic Records." *Postsecondary Education Opportunity* (December 1996); and "Institutional Graduation Rates by Pre-College Characteristics of Students." *Postsecondary Education Opportunity* (March 1997).

[339] Thomas G. Mortenson, "Actual vs. Predicted Institutional Graduation Rates for 1100 Four-Year Institutions."*Postsecondary Education Opportunity* (April 1997), 1.

[340] *Ibid.*

[341] *Ibid.*, 2.

[342] Mortenson, "Freshman to Sophomore Persistence Rates," 6.

[343] Mortenson, "Actual vs. Predicted Graduation Rates," 2.

[344] *Ibid.*

[345] *Ibid.*

[346] *Ibid.*

[347] Johnes and Taylor, "An Evaluation of Performance Indicators," 201-217.

[348] Mortenson, "Actual vs. Predicted Graduation Rates," 1; Mortenson, " Institutional Graduation Rates by Pre-College Academic Records;" and Mortenson, "Institutional Graduation Rates by Pre-College Characteristics."

[349] Clifford Adelman, *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment* (Washington, D.C.: U.S. Department of Education, June 1999); U.S. Department of Education, *The Way We Are: The Community College as American Thermometer* (Washington, D.C., February 1992).

[350] Astin's work spans decades. See previous notes for more on Astin.

[351] Johnes and Taylor, "An Evaluation of Performance Indicators," 201-217.

[352] *Ibid.*

[353] For a complete list of variables used in Astin's regression analysis for predicting freshman grade point averages (GPA) and dropping out, see Astin, *Predicting Academic Performance in College,* 3.

[354] Astin, *Predicting Academic Performance in College,* 3.

[355] Astin, "College Retention Rates," A48.

[356] Astin, *What Matters in College*; 13.

[357] *Ibid.*

[358] Other researchers have found that race and ethnicity do affect student success. See M.T. Eimers and G.R. Pike, "Minority and Nonminority Adjustment to College: Differences or Similarities?" *Research in Higher Education* 38 (1997): 77-97.

[359] Astin, *Predicting Academic Performance in College,* 14.

[360] Vincent Tinto's model, first published in 1975, was the result of earlier work done by Spady in 1970.

[361] See N. Aitken, "College Student Performance, Satisfaction and Retention: Specification and Estimation of a Structural Model," *Journal of Higher Education* 53 (1982): 32-50; N. Baumgart and J. Johnstone, "Attrition at an Australian University: A Case Study," *Journal of Higher Education* 48 (1977): 553-570; J. Bean, "Dropouts and Turnover: The Synthesis and Test of a Causal Mode of Student Attrition," *Research in Higher Education* 12 (1980): 155-187; J. Bean, "Student Attrition, Intentions and Confidence: Interaction Effects in a Path Model," *Research in Higher Education* 17 (1982): 291-320; J. Bean, "The Application of a Model of Turnover in Work Organizations to the Student Attrition Process," *Review of Higher Education* 6 (1983): 129-148; J. Bean, "Interaction Effects Based on Class Level in an Explanatory Model of Student Dropout Syndrome," *American Educational Research Journal* 22 (1985): 35-64; B. Munro, "Dropouts from Higher Education: Path Analysis of a National Sample," *American Education Research Journal* 18 (1981): 133-141; E. Pascarella and D. Chapman, "A Multiinstitutional, Path Analytic Validation of Tinto's Model of College Withdrawal," *American Educational Research Journal* 20 (1983): 87-102; E. Pascarella and P. Terenzini, "Interaction Effects in Spady's and Tinto's Conceptual Models of College Dropout," *Sociology of Education* 52 (1979): 197-210; E. Pascarella and P. Terenzini, "Predicting Persistence and Voluntary Dropout Decisions from a Theoretical Model," *Journal of Higher Education* 61 (1980): 60-75; E. Pascarella and P. Terenzini, "Predicting Voluntary Freshman Year Persistence/Withdrawal Behavior in a Residential University: A Path Analytic Validation of Tinto's Model," *Journal of Educational Psychology* 75 (1983): 215-226; P. Terenzini and E. Pascarella, "Voluntary Freshman Attrition and Patterns of Social and Academic Integration in a University: A Test of a Conceptual Model," *Research in Higher Education* 6 (1977): 25-43; P. Terenzini and E. Pascarella, "The Relation of Students' Precollege Characteristics and Freshman Experience to Voluntary Attrition," *Research in Higher Education* 9 (1978): 347-366; P. Terenzini., "A Replication of a Path Analytic Validation of Tinto's Theory of College Student Attrition" (paper presented at the annual meeting of the American Educational Research Association, Montreal, May 1983).

[362] See Ernest T. Pascarella, John C. Smart, and Corinna A. Ethington, "Long-Term Persistence of Two-Year College Students," *Research in Higher Education* 24, no. 1 (1986): 66.

[363] Clifford Adelman, "Forget What Color You Are; It's Where You Went to School, " *Washington Post* (2 November 1998), A19.

[364] *Ibid.*

[365] Pascarella, Smart, and Ethington, "Long-Term Persistence," 66.

[366] *Ibid.*

[367] *Ibid.*

[368] Burke, “Performance Budgeting and Funding,” 1.

[369] National Center for Research in Vocational Education, *Returns to Education and Training*; and Community College Roundtable, *Core Indicators of Effectiveness.*

[370] Ruppert, *Focus on the Customer*, 3.

[371] See Community College Roundtable, *Core Indicators of Effectiveness*; Serban, “The Performance Funding Wave;” and Calhoun, “Implementing Institutional Effectiveness,” 223.

[372] See Johnes and Taylor, “An Evaluation of Performance Indicators,” 201-217; Astin, *Predicting Academic Performance in College*; and Mortenson, “Actual vs. Predicted Graduation Rates.”

CHAPTER 3
METHODOLOGY

Introduction

As evidenced throughout the literature, performance funding and performance budgeting gained popularity during the decade of the 1990s as a credible and effective means of funding public higher education.[1] However, the growth in this type of funding generated much debate concerning both the types of performance indicators (PIs) used to reflect higher education institutions' quality and the amount of state budgets to be allocated in this manner.[2] Of the states that utilized performance funding or performance budgeting, most did not include a separate set of indicators for their community colleges.[3] This lack of differentiation between the indicators for four-year and two-year colleges created the potential for inequitable distribution of funds within higher education.[4] A model that could accurately predict the success of entering college students (specifically, graduation and/or transfer rates from a higher education institution) could be compared to actual success rates at individual institutions as a measure of institutional performance.[5] This type of model, which was successfully developed for other purposes in the literature, could be extended to the performance-funding arena.

In order to address some of these issues, this research examined the following two areas of inquiry:

The first question was determining how performance assessment and performance measures were used to allocate state funds to postsecondary education institutions. Was performance assessment used for all types of postsecondary institutions—both two-year and four-year colleges and universities? Which states had used, were using, and/or planned to use this type of funding allocation? Of the states currently using performance assessment funding, what portions of their individual budgets did they allocate in this manner? Did states use multiple measures of institutional performance to allocate funds, and, if so, how many did they use? Were institutional performance measures the same for all postsecondary institutions? Specifically, was performance measured differently for four-year and two-year colleges and universities? What measures of postsecondary institutional performance did states most frequently use to allocate funds?

This research question was answered through a review of the literature and is addressed in Chapter 2.

The second question was whether the institutional performance measures used by states and institutions accurately measured the performance of community and two-year colleges. Could the outcome measures most commonly used by states and institutions accurately depict community and two-year college performance? How feasible was the development of performance measures to account for differences in levels and types of institutions? Specifically, was there a model that could serve as an accurate performance indicator for both two-year and four-year postsecondary institutions?

This research question was answered through a review of the literature and through the use of logistic regression analysis to develop a model of community college performance. See Chapters 2 and 4, respectively.

The purpose of this study was to examine the use of performance assessment and performance-based funding and budgeting (PBF&B) in United States community colleges. This study was designed (1) to determine whether current models and PIs used for PBF&B were appropriate for use in two-year postsecondary institutions; and, if not, (2) to develop appropriate PIs through the introduction of a predictive model of community college student performance which could be used to assess community colleges. The database for this analysis contained longitudinal data collected from a nationally representative sample of community college students. The method used to address this question was to first determine the PIs most commonly used for the assessment of four-year postsecondary institutions, and to then develop a model for adapting those indicators to the two-year postsecondary sector.

Source of Data

This study used data from the National Center for Education Statistic's (NCES) study, *Beginning Postsecondary Students* (BPS:90/94).[6]

Participants

Participants in the entire BPS:90/94 study were 10,624 first-time beginning students during the academic year 1989-90, followed from the 1990 National Postsecondary Student Aid Study (NPSAS:90) sample.[7] Through the BPS:90/94 restricted-use database, this researcher had access to individual student data for the 704 two-year college students in the BPS:90/94 sample. Access to the BPS:90/94 restricted-use data required approval by the NCES, which was granted on September 30, 1998.

Target Population

The target population for this study was all students who entered postsecondary education at a two-year or community college for the first time in academic year 1989-1990.[8]

BPS:90/94 Sampling Method

The first step of the BPS study (the NPSAS:90 design) was a stratified multistage sampling design.[9] "The essence of stratification is the classification of the population into subpopulations, or strata, based on some supplementary information, and then the selection of separate samples from each of the strata."[10] According to Kalton, stratification is beneficial because "sample sizes in the strata are controlled by the sampler, rather than being randomly determined by the sampling process. Often the strata sample sizes are made proportional to the strata population sizes; in other words, a uniform sampling fraction is used."[11] In this case the stratified multistage sampling technique, as used in the BPS:90/94 study, was non-proportional—the strata were not proportional to the strata population sizes. This does not create a problem, however, because the two-year sub-population being analyzed in this study (n=704) was large enough to support valid and reliable analyses.

The use of multistage stratified sampling distinguished this sample from those used in past national longitudinal studies of this type. The target population in this study included *all* first-time postsecondary students, regardless of when they completed high school. Because stratified sampling techniques were employed, the two-year college sub-sample (n=704) was a representative sample at the national level.[12] For this reason, the two-year and community college portion of the sample could thus be analyzed separately from the complete sample of 10,624 students in the BPS:90/94 working sample. "The BPS sample is more likely than previous longitudinal studies to include some of the increasing numbers of 'nontraditional' postsecondary students, such as those who have delayed their education due to financial needs or family responsibilities."[13]

BPS:90/94 Data Collection

The Beginning Postsecondary Students Longitudinal Study (BPS:90/94) was conducted as a follow-up to the 1990 National Postsecondary Student Aid Study (NPSAS:90) conducted by the U.S. Department of Education. The NPSAS:90 was prompted by a need for a nationally representative database on postsecondary student financial aid. "The BPS:90/94 followed students identified as first-time beginning (FTB) students in the academic year 1989-90 from the NPSAS:90 sample."[14] A computer-assisted telephone interview (CATI) obtained information concerning "enrollment, program completion, education financing, employment, and family formation; graduate school access and enrollment; and civic participation."[15]

Instrumentation

Computer-Aided Telephone Interview (CATI) methods were used to collect data in the BPS:90/94 study.[16] The BPS:90/94 working sample included all BPS:90/92 eligible respondents and those BPS:90/92 non-respondents for whom BPS-eligibility had not yet been determined.[17] The BPS:90/92 locating database was used to find student cases for the BPS:90/94 full-scale survey. Updated contact information was obtained through a national change of address service.[18]

The sampled students were interviewed on three occasions: in the spring of 1990 (at the end of their first year in college), spring of 1992, and spring of 1994.[19] Prior to CATI operations, mailings were made to each student in the sample.[20] When CATI locating was unsuccessful, "cases were sent to a post-CATI central trace for telephone tracing and, again, as necessary, field locating."[21]

Accuracy of Estimates

As with all estimates derived from a sample, the two broad types of errors in this study were sampling and non-sampling errors.[22] "Random errors reduce the precision of survey statistics, while non-random errors results in bias (i.e., estimates that do not converge to the true population parameter as the sample size increases without limit)."[23]

Sampling errors occurred in this study because the estimates were based on samples instead of the entire population.[24] Non-sampling errors are those that occur even in studies where a complete census of the population is feasible.[25] Sources of non-sampling errors in this study included the inability to get complete information on sample members, ambiguously worded questions, interpretation variability, the inability or unwillingness of respondents to give accurate responses, mistakes in recoding or recording data, other errors in collection, and sampling and estimating of missing data.[26]

According the National Center for Education Statistics (NCES), "sampling errors are primarily random errors for well-designed surveys, like the NPSAS and BPS."[27] The BPS instruments and data collection procedures underwent extensive testing to "minimize non-sampling errors because these errors [were] difficult to quantify and [were] likely to be non-random errors."

Precision of the Survey Statistics

The effect caused by the accumulation of random errors in this study was measured by the standard error of the individual statistics. A standard error of a statistic is the "estimated standard deviation of the sampling distribution of the statistic in repeated samples of the same size using the same sampling design."[28] Because of this, the standard error of a survey statistic depends on the natural variability of the observations in the population, the sample size, and the characteristics of the sampling design.

According the National Center for Education Statistics (NCES), "the features of the sampling design that affect[ed] the sampling variance of the survey statistic include[ed] stratification, multistage or cluster sampling, and unequal probabilities of selection."[29] Of the previous list, stratification was the only sampling design element that could have increased the precision of the estimates (i.e., if the observations were correlated with the stratification variables). The statistical adjustment of the analysis weights used to reduce the potential for nonresponse bias also provided the opportunity for decreased precision of the estimates.

Response Rates

The unweighted BPS:90/94 response rate was 91.4 % among those students known to be eligible for the study.[30] For the two-year segment of this sample, the unweighted response rates were as follows: public institutions 90%; private, not-for-profit institutions 89.4%; private, for-profit institutions 88.6%. [31]

Participant Summary Data

The NPSAS:90 survey, the first stage in the BPS study, provided information concerning "enrollment, program completion, education financing, employment, and family formation; graduate school access and enrollment; and civic participation."[32]

Research Design

Using the BPS:90/94 restricted use dataset, this researcher selected variables found by previous researchers to predict student graduation rates, retention rates, persistence rates, and other related outcomes of higher education. The variables of interest were then downloaded into an SPSS 7.5 Professional Statistics database for further manipulation using a Dell Trinitron personal computer and SPSS 7.5 Professional Statistics computer program for Windows. After the necessary recoding of variables, a logistic regression was conducted to determine those variables most predictive of two-year postsecondary student graduation or transfer rates for this sample.

Statement of the Variables

Independent Variables

Independent variables were those factors thought to influence the outcome variable—graduation or transfer from the two-year and community college students' first college attended. The outcome of the interaction of the independent variables is called the dependent variable. Each of the ten independent variables selected for this regression analysis was defined in the BPS:90/94 technical report, and will be discussed in the following section.[33]

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a. RISK = number of risk factors. This was the number of persistence risk factors possessed by an individual student. Risk factors included delayed enrollment, lack of high school diploma, part-time college attendance, financial independence, parenthood, single parenthood, and full-time employment during college.

b. ACINT= index of academic integration in 1989-90. This average academic integration at the NPSAS institution examined whether an individual student attended career-related lectures, participated in study groups with other students, talked about academic matters with faculty, or met with an advisor concerning academic plans. The mean of the students' responses across these questions was calculated. Each question used in the calculation included four possible responses: 1= never, 2= once, 3= sometimes, 4= often. These responses were then recoded: A student with an average academic integration less than or equal to 1.75 was coded "low"; a student with an average academic integration greater than 1.75 but less than or equal to 2.75 was coded "moderate"; and a student with an average academic integration greater than 2.75 was coded "high."

c. SOCINT= index of social integration. The average social integration at the NPSAS institution examined whether the student had contact with faculty outside of class, went places with friends from school, participated in student assistance centers/programs, or participated in school clubs. The mean of the students' responses across these questions was calculated. Each question used in the calculation included four possible responses: 1= never, 2= once, 3= sometimes, 4= often. Students with an average social integration less than or equal to 1.75 were coded "low;" students with an average social integration greater than 1.75 but less than or equal to 2.75 were coded "moderate;" and students with an average social integration greater than 2.75 were coded "high."

d. FTWORK= worked full time while enrolled. The responses to this question were: "did not work full time while enrolled," or "worked full time while enrolled." Students who considered their primary role during postsecondary education as employees were automatically considered to work full time. The remaining students were categorized as "working full time while enrolled," if they worked an average of thirty-four or more hours per week.

e. EDUCGOAL= educational goals in 1989-90. This variable measured the highest level of education that the student expected to complete, and was recoded from the student's reported educational aspirations in the NPSAS survey. The categories for the student responses were: trade school, two-year degree, bachelor's degree, and advanced degree. This researcher assumed that a student not interested in the attainment of a degree or certificate would respond "none of the above."

f. AGE= age in 1994. This was the student's age as of spring 1994, derived by adding five years to the age of the student when he or she began postsecondary education. The categories were: 24 years or younger, 25-29 years old, 30-34 years old, and 35 years or older.

g. PARED= parental education. Parental level of education was defined as the highest level of education completed by either parent. The categories were: less than high school diploma; high school graduate; some postsecondary education; and bachelor's degree or higher.

h. RELIGION= student's religion. Because past research indicated that both Catholic and Jewish religions were positively correlated with success,[34] this variable was recoded to indicate whether the student was Catholic, Jewish, or neither.

i. NUMDEP= student's number of dependents. This variable reflected the number of dependents the student claimed on his or her tax return in 1989-90.

j. ABILITYH= ability index high. This variable was an indicator of a student's perception of his or her past academic performance, relative to other students. Students with high self-perception of their past academic performance, relative to other students, scored high on this variable.

Moderator Variables

Moderator variables were those variables used to select a certain group from within the larger sample—in this case, beginning two-year postsecondary students. The moderator variables used for this study were:

a. LEVELCON= level and control of institution. Level and control of the referent institution was an aggregate of two variables: (1) level of institution, and (2) control of institution. Of interest to this researcher was the group coded "4"—public and private two-year institutions. A public institution was defined as "a postsecondary educational institution operated by publicly elected or appointed school officials in which the program and activities were under the control of these officials and was supported primarily by public funds."[35] A private, not-for-profit institution was defined as "a postsecondary educational institution controlled by an independent governing board and incorporated under Section 501(c)(3) of the Internal Revenue Code."[36] A two-year institution was defined as "an institution whose program of study result[ed] in an award

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or degree below the baccalaureate level, and [was] at least [two] years but less than [four] years in duration. These institutions [included] many community and junior colleges."[37]

b. INSTID= institution I.D. Each institution was assigned a unique identifier. This variable reflected those assignments.

Dependent Variable

The dependent variable is the outcome variable of interest—in this case, graduation or transfer from the first postsecondary institution attended. The following is a description of the outcome variable utilized in the logistic regression:

OUTCOME= the student outcome of interest to this researcher was graduation or transfer from a two-year institution within the five years from 1990 to 1994 in which the BPS:90/94 study was conducted. Because this variable was a record of whether the student graduated or transferred from *any* postsecondary institution (not necessarily his/her beginning institution), this outcome variable measured student graduation and transfer in their broadest sense.

Method of Collection

The data utilized in this study were obtained from the NCES through a process of verification and permission completed on September 30, 1998.

Individual student data concerning each of the variables of interest were selected and placed in an SPSS 7.5 Professional Statistics data file for further manipulation and analyses. More information about that process is located in the next section, entitled "Method of Analysis."

Method of Analysis

Independent variables, moderator variables, and dependent variables were selected for inclusion in the logistic regression analyses from the Electronic Code Book (ECB) included with the BPS:90/94 restricted use dataset obtained from NCES. These variables were then downloaded into an SPSS 7.5 Professional Statistics file for further manipulation. This working data base, an SPSS 7.5 Professional Statistics file containing only the variables of interest to this researcher, were then filtered to include only those students whose first postsecondary institution was a two-year college. Prior to initiation of any statistical analysis, all data were verified for coding accuracy. Analyses were performed using SPSS 7.5 Professional Statistics for Windows.

After selecting variables to be included in the regression analysis, it was necessary to recode some of the variables. For instance, the student outcome variable was recoded as a dichotomous dummy variable to reflect two categories: "attain/transfer" (yes=1 or no=0).

According to SPSS Inc., all things being equal, logistic regression requires larger sample sizes than does Ordinary Least Squares multiple regression.[38] Because of this fact, it was appropriate to replace all "system missing" data with that variable's mean (i.e., the average score for that variable) to avoid the exclusion of cases. The recoding of missing data in this way allowed the two-year college sample size to remain relatively large (this sample size was 704). This technique is commonly used in situations such as this, where the number of system missing data represents only a small portion of the total variables. The following variables required recoding to account for missing data: the

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ability index variable, the social and academic integration variables, age, number of dependents, parents' education level, and the risk variable.

Frequencies were run for all variables to check for any inconsistencies in the data.

Determination of the Model

To identify any inconsistencies or errors in the data, descriptive statistics were produced for all variables in the working dataset. It was determined that logistic regression was appropriate for this data due to the dichotomous and categorical nature of the dependent variable. In this case, the dependent variable was not the raw data values, but rather, the odds of the event of interest occurring (graduation or transfer from a two-year postsecondary institution within the five years of this study).

Because logistic regression analysis was designed to use a mix of continuous and categorical predictor variables to predict a categorical outcome, or dependent, variable, it was used for these analyses. An in-depth explanation for the use of logistic regression analyses can be found in the next section, "Selection of the Model."

Selection of the Model

"Multiple regression cannot be used to predict the values of a dichotomous dependent variable for two reasons. First, when [used] to predict the values of a variable coded … 0 or 1 we … consider[ed] the predicted values to be probabilities, that is, the probability of obtaining a predicted value of 1. In multiple regression with a straight-line fit to the data, it [was] often the case that values less than 0 or greater than 1 [were] predicted. That [was] clearly a problem."[39]

There were several reasons to use logistic regression—as opposed to multiple regression analysis or discriminant analysis—for this research. First, logistic regression was most appropriate for this data because "the assumptions necessary for hypothesis testing in regression analysis [were] necessarily violated."[40] Predicted values derived from a multiple regression analysis could not be interpreted as probabilities because they were not "constrained to fall in the interval between 0 and 1."[41] In turn, since logistic regression analysis required "far fewer assumptions than discriminant analysis,"[42] it was thought that logistic regression would perform better than the aforementioned analysis techniques.

Logistic regression solved some of the problems involved with using multiple regression analyses for categorical dependent variables. Developed in the 1960s, logistic regression allowed this researcher to predict the value of a variable that varied on a scale from zero to one. The logistic regression curve is S-shaped, and therefore accounted for the non-linear nature of the relationship between the independent and dependent variables utilized in this research.

Subsequent to the determination of the functional form, the model, $\ln(\text{Odds}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$, was selected for use in further analyses. The variables on the right side of the equation were representations of the independent variables and the intercept in a regression equation. Those on the left side of the equation were the natural log of the odds; the quantity ln (Odds) was called a *logit*.

The odds were related to the probability by:

$$\text{Odds} = \frac{\text{Probability}}{1-\text{Probability}}$$

It is important to note that "there is a linear relationship with the independent variables in logistic regression, but it is linear in the log odds and not in the original probabilities."[43]

The logistic equation was transformed into an equation in the probability, which follows:

$$\text{Prob (event)} = \frac{e^{\alpha+\beta_1 X_1+\beta_2 X_2+\ldots+\beta_i X_i}}{1+e^{\alpha+\beta_1 X_1+\beta_2 X_2+\ldots+\beta_i X_i}}$$

To analyze this equation the maximum-likelihood method was employed. The maximum-likelihood method derived coefficients that made observed values most likely for the given set of independent variables. Of the two general goals for logistic regression—determining the effect of a set of variables on the probability of an event occurring, and attaining the highest predictive accuracy possible with a given set of independent variables—the latter was most important to this researcher.

Once the selection of a set of independent variables (i.e., predictor variables) was completed and recoded, the application of a filter for the level and control of the institution (where "4" represented the students attending two-year institutions) was employed, and three types of regression were run.

The step-wise method of model selection was employed to find the best subset of independent variables to predict the dependent variable. Using SPSS 7.5 Professional Statistics software, a forward step-wise WALD was run at the .05 level of significance.

There are two possible purposes for using logistic regression to analyze data: (1) to "determine the effect of a set of variables on the probability of an outcome, plus the effect of individual variables,"[44] or (2) to maximize the accuracy of predicting the

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probability of the outcome variable utilizing a set of predictor variables. According to SPSS Inc., these two functions of logistic regression operate individually from one another.[45] Because this researcher was most interested in "predicting whether a future event will fall in one or the other category of the dependent variable" it was appropriate to focus on the second goal of logistic regression.[46]

The Classification Table produced by logistic regression analysis is a measure of how well the model performs because it is a depiction of how accurately cases are classified into the two categories of the dependent variable (i.e., whether or not a student graduated or transferred from a two-year college within the five years of the BPS:90/94 Study). In other words, the Classification Table addresses how much the prediction is improved over chance.[47]

An appropriate technique for maximizing the predictive accuracy of a logistic regression model includes the manipulation of the cut-off point used for the Classification Table.[48] Because of this, it was appropriate to test several cut-off points for the Classification Table in order to maximize the predictive power of the developed model.

An examination of the probability of the observed results, given the parameter estimates (known as the log of the likelihood), was conducted and used as a measure of the model's fit to the data.

The Nagelkerke Pseudo R^2 was examined to estimate the amount of variance in the dependent variable that could be accounted for by the independent variables in the model.

To check the significance of the independent variables to the model, the Wald statistic was calculated. Multicollinearity was checked to examine the relationships

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between the independent variables. The results of the aforementioned data are included in Chapter 4.

Means

Means are averages of the aggregate, similar data (e.g., the average student age of the sample population). Data means, as appropriate, were calculated and are reported in Chapter 4. Means were calculated for each independent variable.

Model Chi-square

The Model Chi-square is a statistical test of the null hypothesis that the coefficients for all of the terms in the model are zero. This test was conducted and is equivalent to the overall F test in regression. The Model Chi-square is the difference between the initial and final log likelihood. Like the overall F test in regression, the Model Chi-square tests the overall variation in the dependent variable as influenced by the independent variables. Results of the Model Chi-square are reported in Chapter 4.

Summary

This chapter began with an introductory discussion of the nature of the problem to be examined in this research study, and included a discussion of the target population and the design of the study.

The independent and dependent variables used in the analyses were identified and defined. The sources of data, methods of collection, model determination, selection of the model, and methods of analysis were also discussed.

The results of the study, including presentation of the data and analyses, can be found in Chapter 4. A summary of the findings is included at the end of that chapter.

Notes

[1] Joseph C. Burke, "Performance Budgeting and Funding: Making Results Count Where It Matters," *Assessment Update* 10, no .6 (November/December 1998): 1.

[2] See National Center for Research in Vocational Education, *The Returns to Education and Training in the Sub-Baccalaureate Labor Market: Evidence from the Survey of Income and Program Participation 1984-1990* (Berkley: University of California); and Community College Roundtable, *Community Colleges: Core Indicators of Effectiveness: A Report of the Community College Roundtable* (Washington, D.C.: American Association of Community Colleges, National Center for Higher Education, 1994).

[3] Sandra Ruppert, *Focus on the Customer: A New Approach to State-Level Accountability Reporting and Processes for Higher Education* (SHEEO: July 1998), 3.

[4] See Community College Roundtable, *Core Indicators of Effectiveness*; Andreea Serban, "The Performance Funding Wave: Views of State Policymakers and Campus Leaders," *Assessment Update* 10, no. 2 (March/April 1998); and Harriott Calhoun, "Implementing Institutional Effectiveness at Two-Year Colleges," in *A Practitioner's Handbook for Institutional Effectiveness and Student Outcomes Assessment Implementation,* 3rd Ed. (Edison, N.J.: Agathon Press, 1995), 223.

[5] See Jill Johnes and Jim Taylor, "An Evaluation of Performance Indicators Based upon the First Destination of University Graduates," *Studies in Higher Education* 14, no. 2 (1989): 201-217; Alexander W. Astin, *Predicting Academic Performance in College: Selectivity Data for 2300 American Colleges* (New York: Free Press, 1971); and Thomas G. Mortenson, "Actual vs. Predicted Institutional Graduation Rates for 1100 Four-Year Institutions." *Postsecondary Education Opportunity* (April 1997).

[6] U.S. Department of Education, National Center for Education Statistics (NCES), 1990-1994 Beginning Postsecondary Students Study (BPS:90/94).

[7] U.S. Department of Education, National Center for Education Statistics (NCES), 1990 National Postsecondary Student Aid Study (NPSAS:90).

[9] U.S. Department of Education, National Center for Education Statistics (NCES), *Descriptive Summary of 1989-90 Beginning Postsecondary Students 5 Years Later: With an Essay on Postsecondary Persistence and Attainment*, (NCES 96-155), C-1.

[10] Graham Kalton, "Introduction to Survey Sampling," in *Quantitative Applications in the Social Sciences.* (Newbury Park, Calif.: Sage Publications, 1983), 19.

[11] *Ibid.*

[12] U.S. Department of Education, NCES 96-155, C-1.

[13] *Ibid.*

[14] *Ibid.*

[15] *Ibid.*

[17] U.S. Department of Education, National Center for Education Statistics (NCES), *1990-1992 Beginning Postsecondary Students Study* (BPS:90/92).

[18] More information regarding the student and tracing sources for the cases utilized in this study can be found in: U.S. Department of Education, NCES 96-155, C-2.

[19] *Ibid.,* C-1.

[20] *Ibid.,* C-2.

[21] A detailed explanation of data collection for the BPS:90/94 study can be found in U.S. Department of Education, NCES 96-155, C-2.

[22] U.S. Department of Education, NCES 96-155, C-1.

[23] U.S. Department of Education, NCES 96-153, 100.

[24] U.S. Department of Education, NCES 96-155, C-1.

[25] *Ibid.*

[26] A detailed explanation of data collection for the BPS:90/94 study can be found in U.S. Department of Education, NCES 96-155, C-2.

[27] U.S. Department of Education, NCES 96-153, 100.

[28] *Ibid.*

[29] *Ibid.*

[30] U.S. Department of Education, NCES 96-155, C-1.

[31] *Ibid.*

[32] *Ibid.*

[33] U.S. Department of Education, NCES 96-155, C-1.

[34] Alexander W. Astin, *Four Critical Years: Effects of College on Beliefs, Attitudes, and Knowledge* (San Francisco: Jossey-Bass, 1977); Alexander W. Astin, "Financial Aid and Student Persistence," *HERI Research Report Series* 75, no. 2 (Los Angeles: Higher Education Research Institute, n.d.); Alexander W. Astin, *Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education* (Phoenix: Oryx Press, 1993).

[35] U.S. Department of Education, NCES 96-155, B-16.

[36] U.S. Department of Education, NCES 96-155.

[37] *Ibid.*

[38] SPSS, *Advanced Techniques: Regression* (Chicago: SPSS, January 6, 2000), 7-6.

[39] SPSS, *Advanced Statistical Analysis Using SPSS* (Chicago: SPSS, May 14, 1999), 3-2.

[40] Marija J. Norusis, *SPSS Professional Statistics 7.5* (Chicago: SPSS Inc. 1997), 37.

[41] Marija J. Norusis, *SPSS Professional Statistics 7.5* (Chicago: SPSS Inc. 1997), 37.

[42] *Ibid.*

[43] SPSS, *Advanced Statistical Analysis*, 3-3.

[44] SPSS, *Advanced Techniques: Regression,* 7-4.

[45] *Ibid.*

[46] *Ibid.*

[47] *Ibid.,* 7-14.

[48] The cut-off point utilized as a default in the SPSS statistical software is .5— or a 50 percent probability that one of the possible outcomes will occur.

CHAPTER 4
RESULTS

Introduction

The purpose of this study was to examine the use of performance assessment and performance-based funding and budgeting (PBF&B) in United States community colleges. This study was designed (1) to determine whether current models and performance indicators (PIs) used for PBF&B were appropriate for assessing the performance of two-year postsecondary institutions; and, if not, (2) to develop appropriate PIs through the introduction of a predictive model of community college student performance which could be used to assess community colleges.

In order to address some of these issues, this research examined the following two areas of inquiry:

The first question was determining how performance assessment and performance measures were used to allocate state funds to postsecondary education institutions. Was performance assessment used for all types of postsecondary institutions—both two-year and four-year colleges and universities? Which states had used, were using, and/or planned to use this type of funding allocation? Of the states currently using performance funding or budgeting, what portions of their individual budgets did they allocate in this manner? Did states use multiple measures of institutional performance to allocate funds, and, if so, how many did they use? Were institutional performance measures the same for all postsecondary institutions? Specifically, was performance measured differently for four-year and two-year colleges and universities? What measures of postsecondary institutional performance did states most frequently use to allocate funds?

This research question was answered through a review of the literature and was addressed in Chapter 2.

The second question was whether the institutional performance measures used by states and institutions accurately measured the performance of community and two-year colleges. Could the outcome measures most commonly used by states and institutions accurately depict community and two-year college performance? How feasible was the development of performance measures to account for differences in levels and types of institutions? Specifically, was there a single model that could serve as an accurate performance indicator for both two-year and four-year postsecondary institutions?

This research question was answered through a review of the literature and through the use of logistic regression analysis to develop a model of community college student graduation and transfer rates and, subsequent two-year college performance. This chapter will include the results of the logistic regression analyses, which addressed the second research question.

Variables

There were ten major determinants of two-year and community college student graduation and transfer rates upon which there appear to be general agreement among the postsecondary education research community. The following were the independent variables utilized in this study: the number of known risk factors that the student possessed; the student's index of academic integration; the student's index of social integration; whether or not the student worked full-time while enrolled; the educational aspirations of the student; the age of the student; the student's parents' education; the student's religion; the student's number of dependents; and the student's self-reported ability level. The graduation or the transfer of the student from the two-year or community college was the dependent variable utilized for this study.

Independent Variables

The definitions of the selected independent variables included in this study were:

a. The number of risk factors, as measured by the RISK variable, was the number of persistence risk factors possessed by an individual student. Risk factors included delayed enrollment, lack of high school diploma, part-time college attendance, financial independence, parenthood, single parenthood, and full-time employment during college.

b. The index of academic integration in 1989-90, ACINT, was the average academic integration of an individual student at the NPSAS institution first studied. This variable measured whether or not a student attended career-related lectures, participated in study groups with other students, talked about academic matters with faculty, or met with an advisor concerning academic plans.

c. The social integration index, SOCINT, was the student's average social integration at the first institution s/he attended. This variable examined whether the student had contact with faculty outside of class, went places with friends from school, participated in student assistance centers/programs, or participated in school clubs.

d. Whether or not a student worked full time while enrolled at the first postsecondary institution was measured by the FTWORK variable.

e. A student's educational aspirations in 1989-90 were measured by the EDUCGOAL variable. The categories for the student responses were: trade school, two-year degree, bachelor's degree, and advanced degree.

f. A student's age in 1994, measured by the AGE variable, was derived by adding five years to the student's age at the beginning of their postsecondary education career.

g. The parental level of education of a student was defined as the highest level of education completed by either parent and was measured by the PARED variable.

h. A student's religion, measured by the RELIGION variable, was recoded to indicate whether the student was Catholic, Jewish, or neither.

i. A student's number of dependents, measured by the NUMDEP variable, reflected the number of dependents the student claimed on his or her tax return in 1989-90.

j. A student's ability index, measured by the ABILIYH variable, was an indicator of a student's perception of his or her past academic performance, relative to other students.

Moderator Variable

Moderator variables are those variables used to select out a sub-group from the larger sample—in this case, beginning two-year postsecondary students were a sub-group of the larger sample that contained a nationally representative sample of all beginning postsecondary students from all types of postsecondary institutions. The moderator variable used for this study was the level and control of the institution.

The level and control of the institution a student attended, indicated by the LEVELCON variable, was the variable used to focus this research on two-year public college students in the larger sample of all beginning postsecondary students. This variable was an aggregate of two variables: (1) level of institution, and (2) control of institution. An institution's level was defined by the highest degree offered by the institution (e.g., associate's, bachelor's, master's, doctorate). The type of institutional funding and governance defined an institution's control (e.g., public, private, proprietary, nonprofit).

Dependent Variable

The dependent variable was the outcome variable of interest to this researcher—in this case, graduation or transfer from a two-year postsecondary institution. The following is a description of the outcome variable utilized in the logistic regression.

The OUTCOME variable was the dependent variable predicted by the independent variables listed above. The OUTCOME variable measured whether or not a student graduated with a college degree or transferred from a two-year institution within the five years from 1990 to 1994 in which the BPS:90/94 study was conducted. Because this variable was a record of whether the student graduated or transferred from *any* postsecondary institution (not necessarily his or her beginning institution), this outcome variable measured student graduation and transfer behavior in the broadest sense.

Descriptive Statistics

Range of the Data

The reported values for each of the variables included in this study may be expressed as a range (the difference between the lowest value and the highest value). Table 4-1 includes the ranges for each variable included in the logistic regression analyses.

Means

A mean is an arithmetic average of observations. Table 4-1 includes the means for each of the variables included in the logistic regression analyses.

Standard Deviations and Frequencies

The standard deviation of a variable is a "measure of the spread of data about their mean and an essential part of many statistical tests."[1] The frequency of a variable is a tally that takes the form of either numbers or percentages. Table 4-1 includes standard deviations and frequencies (expressed as numbers) of the independent variables utilized in this regression analysis.

ABILITYH had a frequency of 704 (i.e., there were 704 student who responded to this question). The range for ABILITYH was 10 with a minimum of 0 and maximum of 10. In this case, 10 represented the student who felt she was very much above her

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average peer academically. ABILITYH had a mean of 1.04 with a standard deviation of 1.21 and a variance of 1.47.

Table 4-1. Descriptive Statistics.

RISK	ACINT	SOCINT	FTWORK	EDUCGOAL	AGE	PARED	RELIGION	NUMDE	ABILITYH
Mean 1.91 Median 1.00 Mode 0	Mean 2.37 Median 2.00 Mode 2	Mean 2.05 Median 2.00 Mode 2	Mean .23 Median 0 Mode 0	Mean .88 Median 0 Mode 1	Mean 22.31 Median 19.00 Mode 18	Mean 3.59 Median 3.00 Mode 2	Mean .31 Median 0 Mode 0	Mean .37 Median 0 Mode 0	Mean 1.04 Median 1.00 Mode 0
Range 7 Min. 0 Max. 7	Range 3 Min. 1 Max. 4	Range 3 Min. 1 Max. 4	Range 1 Min. 0 Max. 1	Range 1 Min. 0 Max. 1	Range 52 Min. 16 Max. 68	Range 6 Min. 1 Max. 7	Range 1 Min. 0 Max. 1	Range 6 Min. –1 Max. 5	Range 10 Min. 0 Max. 10
SD 1.76	SD .80	SD .73	SD .47	SD .33	SD 7.71	SD 2.00	SD .46	SD .86	SD 1.21
FREQ 704	FREQ 704	FREQ 704	FREQ 672	FREQ 704	FREQ 704	FREQ 704	FREQ 704	FREQ 704	FREQ 704

FTWORK was a dichotomous variable with 0 representing a student who did not work full time while a 1 represented a student who did. Of this group, 67.6% reported that they did not work full-time while enrolled and 32.4% reported working full time while enrolled.

ACINT measured the student's perception of her academic integration at the college she attended. This four-point scale ranged from 1 to 4 with 4 representing the highest degree of academic integration. The most common responses on this four-point scale were 2 (41.3%) and 3 (36.5%), which represented a student who participated in 2 or 3 of 4 possible activities that represented academic integration. The mean score for this variable was 2.37, the standard deviation was .80, and a plot of this variable's frequencies approximated a normal curve.

SOCINT represented the student's perception of his social integration at the college he attended. Of the 704 students responding to this four-point question, the mean was 2.05, with a standard deviation of .73. The plot of this variable's frequencies showed a positive skewness of .428—more than half of the respondents (54.7%) participated in two of the four activities associated with social integration.

PARED, which represented the education level of students' parents, resulted in a mean of 3.59 (they had completed a trade school program but had less than 2 years of college). The mode for this group (2.0) showed that 35.2% of the students had parents whose highest level of education was high school completion with another 12.8% whose parents had less than a high school diploma. These results indicated that 48.0% of the two-year college student subsample were first generation college students.

The RISK variable was a constructed variable with a range of 7 (from zero to 7). This variable was a count of the number of factors a student possessed that were known to be risks to student completion of a college degree. With 704 responses, this variable had a mean of 1.91 and a mode of 0 (29.5% of the respondents indicated that they did not possess any risk factors). This variable's skewness was .566, kurtosis was -.814, and standard deviation was 1.76. Approximately 35% of the students possessed 3 or more risk factors.

The AGE variable indicated whether or not a student had delayed her college attendance after high school graduation—a known risk factor for student graduation and transfer behavior. 41.2% of the students were the traditional college freshman age of 18-years-old. 17.8% of the respondents appeared to have delayed their college enrollment by one year. 31.8% of the respondents were 20 years old or above at the time of their first enrollment in college, which indicated that this group might have delayed their college enrollment after high school completion by two or more years.

According to the NUMDEP variable, 78.6% of the 704 student respondents indicated that they did not have dependents other than a spouse. 21.4% had one or more dependents (other than a spouse).

The RELIGION variable indicated that 29.5% of this subsample indicated that they were Catholic or Jewish and the remaining 70.5% were not.

The educational aspirations of the students sampled, EDUCGOAL, indicated that 87.5% of the students in the two-year college subsample were enrolled with the goal of completing either a bachelor's or associate's degree.

The dependent variable of interest, OUTCOME, indicated that 55.4% of the two-year subsample did not transfer or graduate from a postsecondary institution within the five years of this study. The remaining 44.6% did graduate or transfer within the five-year period of this study.

Analysis of the Data

The data utilized in this study were examined for the purpose of selecting the independent variables and functional form that best predicted the graduation and transfer rates of two-year and community college students in the BPS:90/94 study.[2]

Preliminary analysis of the data (plotting) and this researcher's knowledge of dichotomous dependent variables indicated that the data was of a non-linear functional form. Thus, the equation developed for subsequent analyses was of the non-linear form. A logistic regression model was developed to explain the relationship between the independent variables and the dependent variable.

To hypothesize the expected signs of the correlation coefficients, the following variables were included with their anticipated corresponding signs:

$$\text{GRADUATION/TRANSFER} = f(\overset{-}{\text{RISK}}, \overset{+}{\text{ACINT}}, \overset{+}{\text{SOCINT}}, \overset{-}{\text{FTWORK}}, \overset{+}{\text{EDUCGOAL}},$$

$$\overset{-}{\text{AGE}}, \overset{+}{\text{PARED}}, \overset{+}{\text{RACE}}, \overset{+}{\text{RELIGION}}, \overset{-}{\text{NUMDEP}}, \overset{+}{\text{ABILITY}})$$

$$= \beta_0 - \beta_1\text{RISK} + \beta_2\text{ACINT} + \beta_3\ \text{SOCINT} - \beta_4\ \text{FTWORK} + \beta_5\text{EDUCGOAL} - \beta_6\text{AGE} + \beta_7\text{PARED} + \beta_8\ \text{RACE} + \beta_9\text{RELIGON} - \beta_9\text{NUMDEP} + \beta_{10}\text{ABILITY} + \varepsilon_i$$

Because the literature indicated that increases in the number of risk factors a student possessed would decrease his likelihood of completing a college degree, it was assumed in this research that the RISK variable would be negatively correlated with the OUTCOME variable. Similarly, the degree to which a student was academically integrated with the institution she attended was assumed to be positively correlated with the OUTCOME variable of interest in this research. In the literature, it was found that a student's social integration would increase the probability of a student graduating from a postsecondary institution.[3] Therefore, it was assumed that the SOCINT variable would be positively correlated with the dependent variable (graduation or transfer from a two-year college within the five years of the BPS:90/94 study).

The FTWORK variable, which measured whether or not a student worked full time, was assumed to have a negative relationship with the OUTCOME variable because a student with a full-time job was believed to have less time to concentrate on college studies.

A student's educational goals, as measured by the EDUCGOAL variable, was believed to have a positive relationship with the OUTCOME variable. The higher numbers on the scale represented the higher educational aspirations of a student—a student who did not intend to graduate or transfer would be less likely to do so.

The AGE of a student was assumed to have a negative relationship with the OUTCOME variable because prior research found that the longer a student delayed college enrollment after high school graduation, the less likely that student was to continue on to college graduation.

The level of parental education, measured by the PARED variable, was assumed to have a negative relationship with the OUTCOME variable because prior research indicated that students coming from households where neither parent had attended college were less likely to graduate from college.

A student's religion, as indicated by the RELIGION variable, was assumed to have a positive relationship with the OUTCOME variable because prior research

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indicated that Catholic and Jewish students were more likely to graduate from college than were non-Catholic and non-Jewish students.

The number of financial dependents a student possessed was assumed to have a negative relationship with the OUTCOME variable because it was believed that the more people for which a student was financially responsible, the less time the student would have to devote to college studies.

The student's perception of his academic abilities, ABILITYH, was assumed to have a positive relationship with the OUTCOME variable. This assumption was based on prior research that found that a student's high school grade point average (GPA) was highly predictive of a student's likelihood of graduation from college. Because the ABILITYH variable was seen as a proxy for a student's GPA it was assumed that it, too, would have a strong positive relationship with a student's likelihood to graduate from college.

Missing Data

Although the sample size was 704 for the two-year college subsample, some variables contained missing data, which resulted in a somewhat lower sample size. Overall, the missing data resulted in no less than 615 responses for each variable included in the analysis. Once the logistic regression analysis omitted variables from the final model there were 30 rejected cases due to missing data—the resulting sample size was 674. According to SPSS Inc., "all things being equal, logistic regression requires larger sample sizes than does [Ordinary Least Squares] regression for the correct inference . . . [ideally there should be] at least thirty times as many cases as parameters being estimated in the model."[4] Using the aforementioned rule, the sample size for this research met all such requirements.

Correlations

The results of bivariate correlations showed that 29 correlations were statistically significant at the .05 alpha-level.

Table 4-2 displays the correlations that were significant at the .05 alpha-level.

Purpose of the Model

To address the final research question pertaining to the creation of a flexible institutional performance measure, a logistic regression analysis was conducted to identify a model that could accurately predict community college student graduation and transfer behavior at two-year institutions. The use of logistic regression analysis to develop a model that could accurately predict two-year college student graduation and transfer behavior was an important step toward developing a flexible performance measure for postsecondary institutions. The logistic regression model could offer a way to account for the student characteristics that were largely out of institutional control, but which contributed to the likelihood of college student graduation or transfer within five years (e.g., student's educational aspirations, parental level of education, etc.).

An accurate regression model could utilize incoming student characteristics to *predict* college student outcome—a figure that could later be compared to *actual* student graduation and transfer behavior. The residual (*predicted* versus *actual* student graduation and transfer rates) could offer a fair comparison of institutional performance across colleges and universities. This analysis identified the variables most predictive of

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student graduation and transfer behavior by eliminating the independent variables that did not have statistically significant relationships to the outcome (or dependent) variable.

Table 4-2. Significant Bivariate Correlations.

Variable	Variable	Correlation
PARED	FTWORK	-.095
ACINT	PARED	.089
EDUCGOAL	ACINT	.008
ACINT	ABILITYH	-.097
ACINT	FTWORK	-.174
SOCINT	ABILITYH	-.098
SOCINT	PARED	.137
PARED	ABILITYH	-.141
PARED	AGE	-.229
PARED	NUMDEP	-.221
PARED	OUTCOME	.134
PARED	FTWORK	-.095
RISK	FTWORK	.488
AGE	FTWORK	.146
OUTCOME	FTWORK	-.172
RISK	ACINT	-.186
RISK	SOCINT	-.342
RISK	PARED	-.299
RISK	AGE	.616
RISK	NUMDEP	.558
FTWORK	SOCINT	-.198
ACINT	AGE	-.129
ACINT	OUTCOME	.196
SOCINT	AGE	-.304
SOCINT	NUMDEP	-.204
SOCINT	OUTCOME	.209
RISK	OUTCOME	-.259
AGE	OUTCOME	-.156
EDUCGOAL	OUTCOME	.123

The Resulting Model

The results of the logistic regression analysis lead to an identification of the variables (of those variables tested) that most accurately predicted the two-year college student graduation and transfer behavior during the five years of the BPS:90/94 study. With thirty rejected cases due to missing data, the number of cases included in the analysis was 674. The logistic regression model, which is a nonlinear model, resulted in the following regression equation for this data:

$$\text{Probability (OUTCOME)} = \frac{1}{1+e^{-z}}$$

Where $z = -.6916 + .4173(\text{ACINT}) - .2901(\text{RISK})$

Not all of the independent variables tested were used in the regression equation since, as is the case with multiple linear regression, the contribution of individual variables in logistic regression was difficult to determine. The inclusion of only two independent variables in the model—the ACINT (academic integration) and RISK (number of risk characteristics a student possessed) variables—suggested that these were the only two variables analyzed that could explain a significant portion of the variation in the dependent variable. None of the other eight independent variables analyzed were included in the resulting model.

Interpreting the Logistic Regression Coefficients

The log of the odds, or logit, was:

$$\text{Logit} = \log(\text{Prob (event)}/\ \text{Prob (no event)}) = \beta + \beta x + \ldots + \beta x$$

This model indicated that the coefficient of the RISK variable was -.2901. In other words, when the number of risk variables a student possessed changed from 0 to 1, and the values of the other independent variables remained the same, the log odds of the outcome variable decreased by .2901.[5]

Exponentiated Value of B Coefficient

The exponentiated values of the B coefficients, Exp (B), are the effect of a one-unit change in an independent variable on the log odds of the outcome; this is also called the *odds ratio*. According to SPSS Inc., exponentiated values of the B coefficient "can be interpreted as estimates for the effect of a particular variable, controlling for the other variables in the equation."[6] In other words, the odds ratio indicated the change in the odds of the outcome for a case when the value of that variable increased by one.

In the model developed by this research, the Exp (B) for the ACINT variable indicated that when a student's academic integration increased (from 0 to 1 on the ACINT scale used), the odds of him graduating or transferring within the five years studied were increased by a factor of 1.5178. For the RISK variable, the odds of graduation or transfer decreased by .7482 as the RISK variable changed from 0 to 1.[7]

Accuracy of Prediction

"The classification of cases is a simple matter in logistic regression."[8] The classification table shows a comparison of the model's predicted outcomes to the actual observed outcomes. The classification table's ability to accurately classify cases into the two categories of the outcome variable, according to SPSS Inc., is a "measure of how well the model performs".[9]

The Maximum-likelihood method, which is analogous to the Least-Squares Method in multiple linear regression analysis, resulted in the inclusion of coefficients

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and variables that made the observed results of the sampled students' graduation and transfer behavior most "likely" in the model. In general, if the estimated probability was less than .5, the event was predicted not to occur.

In order to classify cases into the two possible outcome categories (in this case, graduation/transfer or not graduation/transfer) a case is predicted to be in the lower value of the outcome variable if its predicted probability is less than .5 and is otherwise predicted to be in the upper category of the outcome variable. In this case (and in standard statistical procedure), the classification table compared the observed and predicted group memberships when cases with the predicted probability of .5 or greater were classified as graduating or transferring within five years.[10] Table 4-3 is the classification table for the logistic regression analysis.

Table 4-3. Classification Table.

		PREDICTED OUTCOMES		
		0 (= NOT GRAD OR TRANS)	**1** (= GRAD OR TRANS)	**PERCENT CORRECT**
OBSERVED OUTCOMES	**0** (= NOT GRAD OR TRANS)	258	116	**68.98%**
	1 (= GRAD OR TRANS)	142	158	**52.67%**
		OVERALL		**61.72%**

This classification table indicated that the model correctly predicted the outcomes of 258 students who did not graduate or transfer. Also, 116 students who did not graduate or transfer were incorrectly predicted to graduate or transfer. Similarly, 142 students who did graduate or transfer were incorrectly predicted not to graduate or

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transfer. The latter group represented students for whom the community college performed well—these students who possessed qualities known to hinder postsecondary educational success were able to graduate or transfer within five years. The diagonal represented the cases that were correctly classified while the off-diagonal represented the number of incorrectly classified cases.

The *Percent Correct* column of the classification table showed that 68.98% of those students who did not graduate or transfer were correctly classified. Of those who did graduate, 52.67% were correctly classified. Overall, 61.72% of the students were correctly classified.

Goodness of Fit

A model's "goodness of fit" to the data is one way to analyze the strength of the model. There are several statistics used for this purpose, which follow:

The Wald Statistic

The Wald statistic, which is the square of the ratio of the coefficient to its standard error, was 15.87 and 34.87 for the ACINT and RISK variables, respectively. The significance levels for the two Wald statistics were .0001 for the ACINT variable and .0000 for the RISK variable. Using a significance level of 0.05, both the ACINT and RISK variables were significantly different from zero. In other words, the null hypothesis that the ACINT and RISK variables were equal to zero was rejected.

Because the Wald statistic has an undesirable property—mainly, when the absolute value of the regression coefficient becomes large, the estimated standard error is too large—it was necessary to check for large coefficients that would result in failing to reject the null hypothesis. It was determined that this was not the case with this model.

R-Values

An R-value is one way to test the strength of a statistical model. The R^2, which is based on the R-value, indicates the percentage of the variance in the outcome variable that is accounted for by the independent variables in the model. Therefore, as the R^2 becomes larger, the model becomes stronger. The R-values for the ACINT and RISK variables were .1224 and -.1884 respectively, reflecting a relatively small partial contribution to the model.

-2 Log Likelihood (-2LL)

Another way to assess the goodness of fit is to examine how "likely" the sample results actually are, given the parameter estimates. The likelihood is the "probability of the observed results, given the parameter estimates".[11] "It is customary to use –2 times the natural log of the likelihood (-2LL) as a measure of model fit since it has ties to the chi-square distribution."[12]

The –2LL for this model without the independent variables was 926.22. Although small values of –2LL indicate a good model with high likelihood of the observed results, "this fit statistic is not usually interpreted directly".[13] A comparison of the improvement of the –2LL with the independent variables added to the model is a better way to analyze the strength of the model than is the –2LL alone. Although a perfect fit would result in a –2LL equal to zero, once the RISK and ACINT variables were added to the model the log likelihood improved to 862.96. The difference between the –2LL figures (926.22-862.96) results in the Model Chi-square statistic that is covered in the next section of this chapter.

Model Chi-Square

The Model Chi-square is a statistical test of the null hypothesis that the coefficients for all of the terms in the model are zero. The difference between the –2 LL in the model without the two independent variables and the –2 LL in the model with the two independent variables can be found in the Model Chi-square column of the SPSS output. The Model Chi-square, which is analogous to the overall F test for regression, was 63.25 for this model.

Nagelkerke's Pseudo R^2

Nagelkerke's pseudo R^2 is an estimation of the R^2 used for multiple linear regression. Although there are other estimations of the linear regression R^2, Nagelkerke's pseudo R^2 is preferred because it can achieve a maximum value of one. According to this Nagelkerke's R^2, only about 12% of the variation in the outcome variable was explained by the independent variables in the logistic regression model.

Predictive Strength Versus Goodness of Fit

According to SPSS Inc., a model's goodness of fit and its predictive strength do not necessarily correspond. It is likely, for instance, that a model could have strong predictive strength while lacking goodness of fit.[14] Conversely, "as sample size increases, a set of independent variables can be statistically significant, but still not yield a high percentage of correct predictions."[15] In this research the predictive strength of the model was of greater importance than was the significance of individual variables in the

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model, therefore, more emphasis was placed on the classification table results than on the goodness of fit statistics when analyzing the model.

A Hypothetical Example

An example of the utility of this model follows. The following model (as reported and described earlier in this chapter) was developed:

$$\text{Probability (OUTCOME)} = \frac{1}{1 + e^{-z}}$$

$$\text{Where } z = -.6916 + .4173(\text{ACINT}) - 2901(\text{RISK})$$

So, the application of hypothetical individual student data to this model, for a student who rates a 1 on the academic integration scale and who also possesses 2 risk factors, would result in the following equation:

$$\boxed{Z = -.6916 + .4173(1) - .2901(2)}$$

Therefore, the probability of this student graduating or transferring within five years was estimated as:

$$\text{Probability (OUTCOME)} = \frac{1}{1 + e^{(-.8545)}} = .237$$

Where $e = 2.718$ (the base of the natural logarithm)

In general, if the estimated probability of the outcome (as calculated above) is less than .5, the event is predicted not to occur. In this hypothetical case, the model predicts that this student would not graduate or transfer because the calculated estimated probability of the outcome equaled .237 (which is less than the .5 cut-off).

Summary of Findings

Overall, the output for this logistic regression analysis showed that two variables, RISK and ACINT, had some degree of predictive power for the graduation and transfer rates of this group of two-year and community college students. A comparison of this two-year college student model to models constructed (by other researchers) for the four-year college sector indicated that the variables that were predictive of student graduation and transfer behavior at four-year colleges and universities were different than those for two-year college students. The model was able to predict two-year college students who would not graduate or transfer with 68.98% accuracy and those who would graduate or transfer with 52.67% accuracy. Overall, this model accurately predicted 61.72% of the two-year college student outcomes.

Chapter 5 contains the discussion of the results of the study, including a summary of the conclusions. Implications of the study and recommendations for further study follow the summary.

Notes

[1] Arlene Fink, *How to Analyze Survey Data* (Thousand Oaks: Sage Publications, 1995), 97.

[2] U.S. Department of Education, National Center for Education Statistics (NCES), *1990-1994 Beginning Postsecondary Students Study (BPS:90/94).*

[3] Alexander W. Astin, *Four Critical Years: Effects of College on Beliefs, Attitudes, and Knowledge* (San Francisco: Jossey-Bass, 1977).

[4] SPSS, *Advanced Techniques: Regression* (Chicago: SPSS, January 6, 2000), 7-6.

[5] Because of its negative value, this would result in a decrease rather than an increase in value.

[6] SPSS, *Advanced Techniques: Regression*, 7-15.

[7] The question: "How much does this change the probability of the outcome for this individual?" is less straightforward, however. Because the probability depends on where that individual starts, in terms of what her original odds of graduating or transferring were, the change in the odds ratio could be very small, very large, or anywhere in between.

[8] SPSS, *Advanced Techniques: Regression,* 7-5.

[9] *Ibid.,* 7-14.

[10] According to SPSS, a cut-off point other than the standard default of .5 could be used, however, it was not recommended unless the researcher was "very experienced". This researcher conducted exploratory analyses utilizing cut-off points other than .5, but did not find the results to vary significantly from the results gained from using the .5 cut-off. A .5 default cut-off point was therefore utilized. *Ibid.,* 7-10.

[11] *Ibid.,* 7-11.

[12] SPSS, *Advanced Techniques: Regression,* 7-11.

[13] *Ibid.,* 7-12.

[14] *Ibid.,* 7-5.

[15] *Ibid.*

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this study was to examine the use of performance assessment and performance-based funding and budgeting (PBF&B) in United States community colleges. This study was designed (1) to determine whether current models and performance indicators (PIs) used for PBF&B were appropriate for assessing the performance of two-year postsecondary institutions; and, if not, (2) to develop appropriate PIs through the introduction of a predictive model of community college student performance which could be used to assess community colleges.

In order to address some of these issues, this research examined the following two areas of inquiry:

The first question was determining how performance assessment and performance measures were used to allocate state funds to postsecondary education institutions. Was performance assessment used for all types of postsecondary institutions—both two-year and four-year colleges and universities? Which states had used, were using, or planned to use this type of funding allocation? Of the states currently using performance funding or budgeting, what portions of their individual budgets did they allocate in this manner? Did states use multiple measures of institutional performance to allocate funds, and, if so, how many did they use? Were institutional performance measures the same for all postsecondary institutions? Specifically, was performance measured differently for four-year and two-year colleges and universities? What measures of postsecondary institutional performance did states most frequently use to allocate funds?

This research question was answered through a review of the literature and was addressed in Chapter 2.

The second question was whether the institutional performance measures used by states and institutions accurately measured the performance of community and two-year colleges. Could the outcome measures most commonly used by states and institutions accurately depict community and two-year college performance? How feasible was the development of performance measures to account for differences in levels and types of institutions? Specifically, was there a single model that could serve as an accurate performance indicator for both two-year and four-year postsecondary institutions?

This research question was answered through a review of the literature and through the use of logistic regression analysis to develop a model of community college student graduation and transfer rates and subsequent two-year college performance. A review of the literature can be found in Chapter 2.

The purpose of the logistic regression analysis was to develop a model that could accurately predict community college student graduation and transfer behavior at two-year institutions, which could later be used as a performance assessment tool for public two-year colleges. The logistic regression analysis and resulting model offered a way to account for the student characteristics that were largely out of institutional control, but which contributed to the likelihood of college student graduation or transfer within five years (e.g., student race, educational aspirations, parental level of education, etc.).

An accurate model that utilized incoming student characteristics to *predict* college student outcomes could later be compared to *actual* student graduation and transfer behavior as a measure of institutional performance. In other words, the residual (*predicted* versus *actual* student graduation and transfer rates) could offer a fair comparison of institutional performance across colleges and universities. This analysis identified some of the variables most predictive of two-year and community college student graduation and transfer behavior by eliminating the independent variables selected for analysis that did not have statistically significant relationships to the outcome (or dependent) variable.

Ten independent variables, one moderator variable, and one dependent variable were selected, based on prior research, for inclusion in the logistic regression analyses. The longitudinal data resulting from the Beginning Postsecondary Students 1990-1994 Study (BPS:90/94) conducted by the National Center for Education Statistics (NCES) was utilized for the regression analyses. The results of the analyses are included in this chapter following the discussion of the literature review. Further, this chapter includes the conclusions, implications, a summary, and recommendations for further study.

Conclusions and Implications

Performance Assessment for the Allocation of Funds

Overall, performance funding and performance budgeting gained popularity during the decade of the 1990s as a credible and effective means of funding public higher education.[1] However, the growth in this type of funding generated much debate concerning both the types of performance indicators (PIs) utilized to reflect higher

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education institutions' quality and the amount of state budgets to be allocated in this manner.[2] Most states that utilized performance funding or performance budgeting did not include a separate set of indicators for their community colleges.[3] This lack of differentiation between the indicators for four-year and two-year colleges created the potential for inequitable distribution of funds to higher education.[4]

According to the literature, a model that could accurately predict the success of entering college students (specifically, graduation or transfer rates from a higher education institution) could be compared to actual success rates at individual institutions as a measure of institutional performance.[5] Although this type of model was developed successfully for other purposes in the literature, it could be extended to the performance-funding arena.

Performance-based funding and budgeting (PBF&B) research focused mainly on the public four-year postsecondary education sector. Public two-year college literature, although scarce, indicated that few states utilized performance indicators developed specifically for the two-year college sector. The most commonly used performance indicators in the states were absolute measures of graduation and transfer rates.

According to the literature, public two-year colleges had lower graduation and transfer rates than did the public four-year college and university sector. The literature pointed to several contributing factors that explained some of the lower graduation and transfer rates at two-year institutions. Overall, two-year colleges were attended by students with weaker academic preparation, who were more likely to work full time, who had a broader range of academic goals and purposes for attending college, who were more likely to have financial dependents and to be single parents, who attended college

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on a part-time basis, and who had delayed their college enrollment by more than a year after high school graduation.

The differences in the types of students enrolled at two-year and four-year institutions suggested that absolute indicators of institutional performance used to assess both types of institutions (such as graduation and transfer rates) did less to indicate the quality of institutions than they did to describe the type of students enrolled at these institutions. The literature suggested the development of a performance measure that could account for some of the differences in student characteristics. Such a measure could offer a reference norm that would make the comparison of all institutions in a state (both four-year and two-year) more accurate, thus improving the equity of PBF&B within state systems.

A norm-referenced performance indicator could be developed through a multivariate regression analysis using incoming student characteristics as the independent variables and graduation or transfer as the dependent variable. A model, which resulted from the logistic regression analysis, could accurately predict two-year college student graduation and transfer behavior based solely on incoming student characteristics. A predicted graduation or transfer rate for an institution could then be compared to actual rates as a measure of performance.

The lack of a nationally representative longitudinal database of public two-year college students was the greatest barrier to developing a norm-referenced performance indicator for community colleges. Because the BPS:90/94 was the first study that included a national sample of all beginning postsecondary students, it offered the means for developing a norm-referenced performance indicator.

Analysis of Logistic Regression Results

The logistic regression analysis addressed the second area of research inquiry in this study. For the purpose of this research, it was believed that four-year college variables discovered by previous researchers might be appropriate for the prediction of two-year student graduation and transfer rates. Because four-year college student studies were the only prior research conducted of this kind, they would provide a starting point for two-year college student predictions.

Based on prior research conducted about the four-year sector, it was assumed that the following ten variables would affect graduation and transfer rates of two-year students in the following way:

1. The RISK variable was assumed to have a negative relationship with the outcome variable, OUTCOME, because it was believed that the more known risk factors a student possessed the less likely that student was to graduate or transfer from college within five years.
2. The academic integration of a student, ACINT, was believed to have a positive relationship with the OUTCOME variable because this variable should measure the degree to which a student was integrated with the academic aspects of his college.
3. The SOCINT variable, the degree to which a student was socially integrated with her college, was assumed to have a positive relationship with the OUTCOME variable.
4. A student who worked full time, measured by the FTWORK variable, was assumed to have a negative relationship with the OUTCOME variable

because a student with a full-time job was believed to have less time to concentrate on college studies.

5. A student's educational goals, as measured by the EDUCGOAL variable, was believed to have a positive relationship with the OUTCOME variable because the higher numbers on the scale represented the higher educational aspirations of a student—a student who did not intend to graduate or transfer would be less likely to do so.
6. The AGE of a student was assumed to have a negative relationship with the OUTCOME variable because prior research found that the longer a student delayed college enrollment after high school graduation, the less likely that student was to continue on to college graduation.
7. The level of parental education, measured by the PARED variable, was assumed to have a negative relationship with the OUTCOME variable because prior research indicated that students coming from households where neither parent had attended college were less likely to graduate from college.
8. A student's religion, as indicated by the RELIGION variable, was assumed to have a negative relationship with the OUTCOME variable because prior research indicated that Catholic and Jewish students were more likely to graduate from college than were non-Catholic and non-Jewish students.
9. The number of financial dependents a student possessed, NUMDEP, was assumed to have a negative relationship with the OUTCOME variable

because it was believed that the more people for which a student was financially responsible, the less time the student would have to devote to college studies.

10. The student's perception of his academic abilities, ABILITYH, was assumed to have a positive relationship with the OUTCOME variable. This assumption was based on prior research that found that a student's high school grade point average (GPA) was highly predictive of a student's likelihood of graduation from college. Because the ABILITYH variable was seen as a proxy for a student's GPA it was assumed that it, too, would have a strong positive relationship with a student's likelihood to graduate from college or to transfer to a four-year college within five years.

The above assumptions regarding the relationships between eight of the ten independent variables and the outcome variable were confirmed by this research. Two of the ten independent variables did not show significant correlations with the dependent variable—RELIGION and NUMDEP (number of dependents).

The correlation analysis conducted prior to the logistic regression indicated that the following independent variables had statistically significant relationships with the dependent variable (at the .05 alpha-level): ACINT, SOCINT, RISK, AGE, EDUCGOAL, PARED, ABILITYH, and FTWORK.

The lack of statistically significant relationships between two of the independent variables and the outcome variable may be due to the fact that they were not strongly related to the graduation or transfer behavior of community college students. Other possible explanations for the lack of statistically significant relationships include the measurement error associated with collecting data from students (as opposed to more reliable student academic transcript data) or coding errors associated with data entry and similar activities.

The possibility that a student's religion and number of dependents were more strongly related to the graduation and transfer behavior of four-year students than they were to two-year college students may actually be due to the greater diversity of students (in terms of these two factors) at two-year colleges. The degree of academic and social integration of a student may increase as a student perceives herself as being similar to other students in her classes. Increases in integration may result in an increased likelihood of a minority student graduating of transferring from a two-year institution. So, although a four-year college student's religion and number of dependents may be predictive of her likelihood of college graduation and transfer, they appeared to have less significance in this two-year college study.

The logistic regression analyses resulted in a model that included only two of the ten independent variables tested. Such a situation suggested that (of the ten independent variables included in this research) only the RISK and ACINT variables were *predictive* of the graduation and transfer behavior of two-year college students (as opposed to those variables merely being *related to* graduation and transfer behavior). The predictive strength of the model also suggested that a stronger model could be developed with independent variables that had more influence on the transfer and graduation behavior of community college students.

It seems likely that there are other variables that were not included in this regression, which might improve the predictive strength of this model. For instance, although high school grade point average (GPA) data was not collected in the BPS:90/94 study, this data is thought to be highly predictive of student success in college. In fact, GPA has been utilized as common admissions criteria by postsecondary institutions for decades. Unfortunately, because of the high percentage of two-year college students who postpone college attendance for more than a year after high school graduation, GPA may not be as accurate at predicting two-year college student success as it is in the four-year college sector.

Standardized test scores from tests such as the SAT and the ACT are also useful predictors of college student success. In conjunction with high school GPA, SAT and ACT scores are commonly used to predict college student success for college and university admissions purposes. Unfortunately, because of the open-door policy at community colleges (i.e., the lack of admissions requirements) most community college students do not take the SAT nor the ACT.

Overall, it appeared that although eight of the independent variables were correlated with the outcome variable (at the .05 alpha-level), the regression analysis indicated that there might be other variables that could more accurately predict two-year college student graduation and transfer rates. Because the independent variables were selected based on four-year student research, it appeared that the variables selected might not be adequate.

The results of the bivariate correlation and logistic regression analyses suggested that predictors of two-year and four-year college student graduation and transfer behavior differed. This finding supported the belief that more longitudinal data should be collected about two-year college students. Without such data, it is unlikely that a flexible institutional performance indicator can be developed for use in both the four-year and two-year college sectors. Consequently, without a flexible performance indicator that can accurately assess the performance of two-year colleges, these institutions will continue to be subjected to the standards of four-year institutions—standards that are inappropriate for use in the two-year college sector.

As states continue to adopt performance-based funding and budgeting schemas for the allocation of funds to postsecondary education, they should continue to search for ways to fairly and adequately fund all sectors of higher education. An approach that takes into account the differences in the populations served by the various postsecondary sectors would offer a way to reward institutions for their academic and managerial practices instead of rewarding them for the type of student they enroll.

Summary

In summary, the literature revealed that performance assessment and performance measures were used to allocate state funds to postsecondary education institutions for all types of postsecondary institutions—both two-year and four-year colleges and universities. The majority of the states had used, were using, or planned to use this type of funding allocation, but most states preferred to allocate only small portions of their funds in this manner. Although most states used multiple measures of institutional performance to allocate funds, graduation and transfer rates were used in nearly all of the states. In most cases institutional performance measures were the same for all postsecondary institutions within a state, which meant that performance was not measured differently for four-year and two-year colleges and universities.

Results from the literature review provided justification for the development of a flexible performance indicator that could account for student characteristics when assessing institutional performance. The review of the literature also provided data and suggestions for the variables included in the logistic regression analyses. Several student characteristics found to be influential in the four-year sector appeared to be appropriate predictors for the two-year college sector—although they were not completely adequate.

Recommendations for Future Study

Improvement of the model may include the addition of other variables from the *Beginning Postsecondary Students 1990-1994* study in the logistic regression analysis. New data from the National Center for Education Statistics (NCES) also includes a follow-up to the original BPS:90/94 study and may provide data for the improvement of the model.

More in-depth analyses of the data used in this research may also prove useful. Specifically, testing the components of the constructed RISK variable while excluding the actual RISK variable may result in a model that better fits the data. Also, since the variables used in these analyses were selected on the basis of prior research conducted about four-year colleges and students, it is necessary to explore variables not yet used in this type of research.

Another tactic for improving the prediction of graduation and transfer rates may be to use institutional data obtained from ACT, Inc.[6] The data collected by ACT, Inc.

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may result in a better fit between the data and the model. The anticipated result would be a more accurate prediction of the outcomes of concern.

Once a model is developed that can adequately predict the graduation and transfer behavior of two-year college students, the next step will be to apply institutional data to the new model. This application will result in the prediction of student graduation and transfer behavior at various institutions, which can then be compared to actual graduation and transfer rates at those same institutions. Because the necessary institutional data for community colleges has been found in Florida, this state is a good candidate for the analyses.

Notes

[1] Joseph C. Burke, "Performance Budgeting and Funding: Making Results Count Where It Matters," *Assessment Update* 10, no .6 (November/December 1998): 1.

[2] See National Center for Research in Vocational Education, *The Returns to Education and Training in the Sub-Baccalaureate Labor Market: Evidence from the Survey of Income and Program Participation 1984-1990* (Berkley: University of California); and Community College Roundtable, *Community Colleges: Core Indicators of Effectiveness: A Report of the Community College Roundtable* (Washington, DC: American Association of Community Colleges, National Center for Higher Education, 1994.)

[3] Sandra Ruppert, *Focus on the Customer: A New Approach to State-Level Accountability Reporting and Processes for Higher Education* (SHEEO: July 1998), 3.

[4] See Community College Roundtable, *Core Indicators of Effectiveness*; Andreea Serban, "The Performance Funding Wave: Views of State Policymakers and Campus Leaders," *Assessment Update* 10, no. 2 (March/April 1998); and Harriott Calhoun, "Implementing Institutional Effectiveness at Two-Year Colleges," in *A Practitioner's Handbook for Institutional Effectiveness and Student Outcomes Assessment Implementation,* 3rd ed. (Edison, N.J.: Agathon Press, 1995), 223.

[5] See Jill Johnes and Jim Taylor, "An Evaluation of Performance Indicators Based upon the First Destination of University Graduates," *Studies in Higher Education* 14, no. 2 (1989): 201-217; Alexander W. Astin, *Predicting Academic Performance in College: Selectivity Data for 2300 American Colleges* (New York: Free Press, 1971); and Thomas G. Mortenson, *Postsecondary Education Opportunity* (Mortenson Research Seminar, April 1997).

[6] ACT, Inc. is an independent, nonprofit organization that provides educational services to students and their parents, to high schools and colleges, to professional associations and government agencies, and to business and industry. ACT's ASSET paper and pencil test was administered to over 775,000 students at more than 500 two-year colleges in the academic year 1998-99.

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Sharon Betty Whigham was born in Tampa, Florida. She received her bachelor of arts degree from the University of Florida in 1994. She was awarded a master of arts in speech communication and community college education in 1996 from the University of South Florida in Tampa.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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